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STEAM-PIPE COVERINGS.

We publish in this issue, on another page, an interesting communication from Dr. Silvanus P. Thompson. This takes up the relative values of various compositions for the insulation of steam pipe. Information on this subject is of great importance to the engineer. While efforts are being made to secure complete combustion of fuel and to increase the efficiency of boiler equipments and steam engine installations, not a little of the success of a steam plant depends upon the character of the piping system employed. The loss caused by condensation of steam in its passage from the boiler to the steam chest is inherent, but it can be decreased by a proper use of high-class insulating fabrics. Where it is necessary, through unfortunate conditions of location, to have a long line of piping, the matter becomes one of greater importance. A contribution on this subject from so eminent an authority will, of course, be welcomed by the engineer.

PROTECTION AGAINST LIGHTNING.

The committee appointed some time ago by the National Fire Protection Association has submitted a preliminary report which contains a good deal of interesting information with regard to lightning protection and the value of protective apparatus. Out of an average of 71,469 fires from all causes in a year, 3,151 were caused by lightning. These involved a loss in the same year of $4,353,437, out of a total loss from fires from all causes of $156,000,000. Of the buildings affected by fires due to lighting, barns suffered the most heavily, with dwellings next in order, and churches following.

One of the conclusions of the committee is to the effect that buildings with steeples and gabled roofs are much more susceptible to lightning strokes than those with flat roofs. The prevailing form of construction for church edifices, however, is that of the gabled roof supplemented with the steeple. The probable immunity of these edifices during the five years under discussion may have been due to the lightning-rod protection with which they are usually equipped. It would have been interesting if the committee had secured and published figures showing what proportion of the dwellings and barns struck were equipped with such apparatus, and also what proportion of the churches struck were similarly equipped. It would also have been interesting to have determined what was the ratio between the proportions of dwellings struck to the total number of dwellings under investigation, and the number of churches struck to the total number of churches under investigation.

There is a good deal of doubt extant as to the utility of the lightning rod as a protective apparatus. At the same time, $4,353,437 would have bought a good deal of lightning-rod equipment. The cost of affording a building the most complete lightning-rod protection that man can devise is very small compared with the total loss which would accrue due to a disastrous lightning stroke; and if the conclusions of the committee are well founded—as we have every reason to believe they are—a considerable loss could have been avoided by the proper installation of protective apparatus.

The report gives a number of suggestions as to the material to be used and the method of installation to be followed. Various areas require different forms of protection, and various metals and materials of building construction also require different styles of equipment. An important suggestion is that the conductor should not be insulated at any point from the building to be protected, but should be fastened firmly thereto by material of the same nature as the conductor. Whether this is generally understood is not known, but it is a fact that lightning conductors have often been found fastened to the roofs of buildings, and then, on their course from roof-trees to the ground, have been passed through insulating spools.

The organization which undertook this investigation is very sincere in its desire to lessen the effect of lightning strokes, and its conclusions are certainly worthy of consideration, not only by the house owner, but by the constructing engineer as well.

SURPLUS WATER POWER.

Water goes idly over the dam at many electric power stations during some hours on most days of the year. The more nearly the normal power of a stream is able to carry the maximum loads of an electric system, the greater is usually the amount of water that escapes without doing useful work.

Why There Is a Surplus.

This surplus of water power is, of course, due to the fact that at most generating stations of electrical supply systems the average day load is hardly more than one-half of the maximum evening load, and the late night load ranges between ten and thirty per cent of this maximum.

If the normal flow of a river is sufficient to carry the maximum electric load there is evidently a large loss of surplus water during all save one or two hours per day. Even where some storage of water is resorted to in order to obtain a sufficient supply for the hours of heaviest load, this storage does not usually absorb the entire flow of the stream during the remaining hours of each day, in most months of the year. As a result of these conditions one-quarter to one-half of the entire volume of water passing an electric station often escapes as surplus power.

Why Not Make Use of This Surplus?

Most of this loss of water would be prevented if full loads were obtained for those hours when the present demands for power are much below the maximum. Any increase of revenue from new loads at those times of day when much of the generating equipment is now idle would be nearly all clear gain, because operating expenses are nearly constant whatever the load, in systems where the water power is owned. At least one of the generators in most water-power stations must be kept at work, and the labor charge is usually no greater when all are in operation. The only important expense of more nearly continuous operation at full capacity would be some additional wear on machinery. In this respect water-power plants differ from steam-driven electric stations where labor varies roughly and fuel consumption approximately with the load. Lacking unusual storage facilities the power stream at an electric station has got to go, and

> The mill will never grind again
> With the water that has past.

Utilization of surplus water power seems to depend on what possible electric loads can be got at those times of day when it is available, and on a sufficient reduction of rates to make electric power attractive to those who command these loads. As to the first of these conditions, that is the existence of possible loads, there can be no doubt. Motor loads have already done much to increase the outputs of electric stations during the regular working hours of week days, but there is room for much more expansion in this direction. Electric heating for industrial purposes generally and for cooking might absorb an amount of power far beyond the capacity of present stations during daylight hours. During one-half of each year there is the practically unlimited demand for the warming of buildings which extends in varying amount over the entire twenty-four hours. In the other half of the year ice-making and the cooling of buildings offer large loads.

Chemical and metallurgical work might absorb great quantities of electrical energy in almost every city were it available at attractive rates. Great industries of this sort are moved to out of the way places like Sault Ste. Marie or Massena in order to obtain cheap electric power, and similar but smaller enterprises would be attracted to any city or town where energy could be had at low cost.

Is the Plan Practicable?

It may be questioned whether enough of the industries just mentioned could be carried on late at night to keep an electric system nearly loaded, but there seems to be little doubt on this point. Certain it is that large manufacturing plants can be induced to change their working time during daylight hours in order to take advantage of cheap electric power. A notable example of this fact may be seen in the plant of the Dominion Cotton Mills Company, of Montreal, Canada, which stops operations at four o'clock in the afternoon of every week-day between September 15 and March 15 because it can not obtain electric power from the supply system there after that hour of the day. These cotton mills are provided with a steam power plant which stands idle even during those hours when electric energy can not be had for the motors. The twenty-seven motors that drive the machinery of these cotton mills have an aggregate capacity of 3,412 horse-power, and the plant is thus of a size that is usually supposed to be beyond the reach of electric supply systems as to the sale of motive power.

While the daylight hours of operation may probably be changed or even shortened in most manufacturing plants for the sake of cheap electric power, there are no doubt many industries where the period of operation can not be extended into the second half of the night. On the other hand there are a few lines of production where the cost of energy is of prime importance, and where the work could be shifted to even the small hours of the night for the sake of cheap electric current. Some of the chemical and metallurgical applications of electricity are of this sort. Some lines of work naturally require their supply of energy during the second half of the night. Thus in every city a great quantity of bread is baked between midnight and morning.

Reserve Power to Charge Storage Batteries.

Another possible method of applying energy developed during the night to industries that require cheap power is that which employs storage batteries on the premises of consumers. Of course the great objection to these batteries where large volumes of energy are sold at low rates is their large first cost, but they are available in some cases. This suggested use of batteries is quite distinct from their ordinary employment to store energy that can subsequently be sold for light or power at usual rates.

But it may be urged that prices of electrical energy can not be made low enough to do the work of warming buildings

baking bread, chemical processes and such industries as are or might be carried on between midnight and six or seven A. M. Everything, of course, turns on this point, but when generators and transmission and distribution lines are almost idle and large volumes of water are going over the dam, it seems that any rate which the traffic will bear should turn to the advantage of the electric system. Certain it is that the steam railways have found it profitable to haul certain classes of freight at any prices that could be got above the bare cost of additional labor and fuel without regard to office expenses, depreciation charges or interest accounts.

Looked at from this standpoint the case for surplus water power is more hopeful. Take, for instance, the problem of electric heating on a large scale in competition with illuminating gas. When of good quality such gas contains 650 potential heat units per cubic foot, but owing to imperfect combustion and to the high temperature of the escaping products hardly more than 325 heat units per foot are available for useful purposes. At one dollar per 1,000 feet, the lowest common price of gas, the heating power just named gives 3,250 units for one cent.

At one cent per kilowatt-hour, a rate that might frequently be made with profit for surplus water power, the electric energy would yield 3,438 heat units for one cent, beating gas in its strongest position.

With prices for the same heating effect nearly equal there is little reason to doubt the choice of the average consumer.

THE RISE OF THE WIRELESS.

The receipt of a telegraphic message from Nome, Alaska, marked the inauguration of the government wireless line from Nome to St. Michael. It is stated that this wireless system is working perfectly. From St. Michael the message came by a wire line up the Yukon to Dawson, and thence to Seattle, traveling 3,500 miles altogether. The establishment of this service is another proof of the soundness of the ideas of many believers in wireless telegraphy as to its utility when supplemented by cable telegraph systems. While a number of inventors have, from time to time, made experimental demonstrations of the ability of their systems to transmit messages over considerable distances without wires, it is for relatively short spans that the wireless systems have had their greatest successes. There are numbers of places which are now without communication because of the absolute difficulty of laying either land or submarine lines, which could be brought into communication by means of wireless sending and receiving stations, and this service so supplemented by land lines and submarine cables that complete communication could be established. It is probable that the work now going on in army and navy administrations will do a good deal toward coordinating this mixed service. The continued reports of excellent work done by the various systems in all parts of the world seem to warrant the assumption that very soon we shall be enjoying a service of very great utility, even if it does not possess all the elements of universality.

Temperature Coefficients of Steel Rails.

The World's Fair Street Railway Commission which is making exhaustive electrical tests at the Bullock Electric Manufacturing Company's exhibit at section No. 15, Palace of Electricity, under the direction of Professors Norris, of Cornell, Swenson, of Wisconsin, and Plum, of Perdue, got some interesting results last week while testing the temperature coefficients of steel rails.

These tests are made by taking the resistance of the rail at a normal temperature, then passing a large enough current through the rail to raise its temperature through a range of thirty degrees centigrade, and at various stages of heat making other tests. The results so far have been rather surprising. There seems to be but little difference in the resistances at the various temperatures. It has been suggested that this may be due to the presence at the same time of iron and carbon in the steel, the one losing in conductivity, while the other gains with the rise of temperature. So far the drop in voltage has been found to be much smaller with direct than with alternating current and that it varies much with the variations of current density and saturation. The relationship has not been established. Tests for this purpose will now be made with constant wave-forms, those heretofore used having varied some in this respect.

The Eastern Telegraph Company to Use Wireless Telegraphy.

The Eastern Telegraph Company, of London, will make a limited use of wireless telegraphy. While they do not feel that wireless will compete with long-distance submarine telegraphy, they are disposed to use it at some places where cables, on account of existing conditions, could not be used. This is especially the case in the Azores Islands. The government of Portugal was desirous of connecting some of the outlying islands by telegraphic communication, but the nature of the bottom was such that cables will not be practicable. These will be served by the wireless system.

Large Station for Wireless Telegraphy.

Mr. Richard Guenther, consul-general at Frankfort, Germany, announces that the large wireless telegraph station at Pisa, Italy, will be completed early in September. The buildings will be entirely of stone. As it will take some time to put the machinery and apparatus in place, it is probable that the station will not be ready for receiving and transmitting messages before the beginning of next year. The station will be called Coltano. It is designed to establish wireless telegraphic communication from there with Great Britain, Holland, the United States and Canada, and with vessels in the Mediterranean, the Baltic Sea, the Red Sea and the Atlantic and Indian oceans.

Electrical Railway Statistics.

The electrical railroads of the United States carried last year three times the population of the world. Capital invested in electric railroads is twice as much as the United States bonded debt. The gross earnings were $250,000,000 and the taxes paid $13,000,000.

Supply of Platinum.

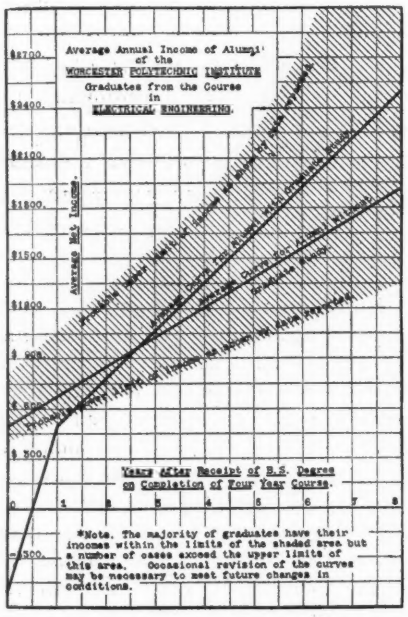
In view of the constantly increasing demand for platinum and the limited supply, the source being almost entirely restricted to the Ural Mountains in Russia, it is very probable that the price will increase. The Russian-Japanese war is beginning to have its effect.

Records of Our Electrical Engineering Graduates.[1]

The value of a thorough education fitting a young man for his lifework is no longer a debatable question. The recent report of the United States Bureau of Education shows that a boy with a common school education has practically one chance in 9,000 of general recognition as a successful man in some department of human endeavor and usefulness.

A high school education increases his chances of such success by about twenty-two times, while a college education gives a young man about ten times the probability of success and advancement possessed by the high school graduate, or about two hundred times the opportunity open to the boy with only a common school education.

While the basis of income which a man


Average Annual Income of Alumni of the WORCESTER POLYTECHNIC INSTITUTE Graduates from the Course in ELECTRICAL ENGINEERING.
$2700.
$2400.
$2100.
$1800.
$1500.
$1200.
$ 900.
$ 600.
$ 300.
0
Average Net Income.
Years after Receipt of B.S. Degree on Completion of Four Year Course.
1
2
3
4
5
6
7
8
*Note. The majority of graduates have their incomes within the limits of the shaded area but a number of cases exceed the upper limits of this area. Occasional revision of the curves may be necessary to meet future changes in conditions.

CURVE OF FINANCIAL PROSPECTS FOR ENGINEERING GRADUATES.

may be able to secure is, in many respects, a false standard of comparison, yet it is perhaps as definite a measure of his worth as any single method at our command. For this reason, the following data presented by Mr. Dodge in his recent presidential address before the American Society of Mechanical Engineers is of much interest. From carefully prepared averages he found that in engineering work the average unskilled man at twenty-two years of age has reached his maximum earning capacity of $510 per year, which, capitalized at five per cent, gives him a potential value of about $10,000. The shop-trained man reaches his maximum of $790 per year at twenty-four years of age, while the curve of income for the technical school graduate of ten years' standing is still rising at thirty-two years of age, when he receives an annual income of $2,150 which gives him a potential value of $43,000 when capitalized at five per cent.

Although this result, as shown by Mr. Dodge, has been criticised as being more favorable to the technical graduate than is justified in the average case, the accompanying diagram, which has recently been prepared from data received from graduates of the Worcester Polytechnic Institute in electrical engineering, substantiates the conclusions drawn by him and further emphasizes the value of a thorough technical training such as that given by the Worcester Polytechnic Institute.

This diagram is probably unique in that it shows most completely the financial prospects of technical graduates from year to year. As the department of electrical engineering at the Worcester Polytechnic Institute has been established but eight years, there are data available for this period only, but during this time a large number of students have graduated, and data have been received from a sufficient number of them to represent conditions fairly. From these curves, it is seen that the average graduate who receives $500 per year for his first position after leaving the Institute rapidly increases in value, so that, at the end of eight years, he may expect to receive an income of about $1,900; or, if he has been a graduate student at the Institute for one year, his income is shown to average about $2,500, which, capitalized at five per cent, gives him the income on an investment of about $50,000. By investing five years of his time and the cost of his college training, he has after a few years and for the remainder of his life increased his income earning value by not less than $40,000.

[1] Advanced sheet from the forthcoming (November) number of the *Journal of the Worcester Polytechnic Institute.*

A New Independent Telephone Association.

At a meeting held at Bloomington, Ill., last week, the Central Illinois Independent Telephone Association was organized, and Mr. Albert Schuler, manager of the Independent Telephone Association, of Streator, was made president of the preliminary organization. The temporary president and Mr. R. C. Critchfield, of Minier, temporary secretary, with E. F. Hyneman, of Lexington, were selected to prepare a constitution and by-laws, and to issue a call for another meeting as soon as possible, to take place in Peoria, Ill.

Railless Electric Roads.

There are a number of railless electric roads operating in Germany, but they do not seem to be as great a success as was expected. The expense of operating is very high and the electric energy required to move cars over roads exceeds by one hundred per cent the power necessary to draw cars over iron rails. Under these circumstances, it is doubtful whether the additional cost of power will not be greater than the interest on the additional investment involved in the use of rails.

Meeting of Incandescent Lamp Manufacturers.

About twenty of the manufacturers of incandescent lamps met at the Manhattan Beach Hotel on August 12 and 13 to discuss various trade matters pretaining to the present situation in the incandescent lamp industry. The general feeling among these manufacturers is that of confidence and the anticipation is general that a most active season is approaching in this branch of electrical manufacturing.

Imports of Electrical Goods into England.

For the five months ending with May, the foreign electrical goods imported by the United Kingdom reached a total of £327,928, which contrasted with £300,480 for the corresponding period of 1903 and £283,702 for the first five months of 1902.

Protection of the Third Rail.

The Northeastern Railway Company, England, has protected its third rail in a very simple yet seemingly efficient manner. Two iron or steel ridges have been erected, one on either side of the track, running parallel with and above the rail, so that it is impossible in stepping over or across to come in contact with it.

New Power for an Old Paper.

The *Graphic*, London, has its new offices equipped with the most modern and approved electric power. Electricity is used for lighting, electrotyping, driving all the presses and the auxiliary apparatus, and has proved very satisfactory.

In the City of Mexico the Mexican Permanent Exposition Company has been organized for the purpose of holding a permanent exposition there of the products of other countries best adapted to Mexican uses.

POLYPHASE SUBSTATIONS.[1]

BY S. L. PEARCE.

(*Concluded.*)

EXAMPLES OF MOTOR-GENERATOR EQUIPMENTS.

Figs. 3 and 4 show two typical equipments for the substations of the Manchester corporation. The Polygon is one of ten stations, the general design in each case being the same, although the size and arrangement are modified to suit local conditions. The building is divided into two bays, the larger containing at the one end the traction motor-generators, also the separate high and low-tension switchboards. At the other end are placed, similarly, the lighting motor-generators and balancing sets, and the corresponding high and low-tension switchboards. In the second bay provision is made for extension sets.

Each traction set consists of a synchronous motor operating direct at 6,500 volts, and coupled to a 220-kilowatt, continuous-current, compound-wound generator, the exciting current for the motor field being obtained from an exciter mounted on an extension of the shaft, or, as an alternative, from the lighting bus-bars. Each lighting set similarly consists of a synchronous motor direct coupled to a 220-kilowatt, continuous-current, shunt-wound generator to give 420 to 430 volts across the outers of a three-wire system, and they are also so arranged as to give 210 volts on either side of the middle wire. The exciting current for the motor is taken from the terminals of the low-tension generator, or, as an alternative, from the lighting bus-bars. The balancing sets, one of which is provided in each station, consist of a 125-kilowatt, three-phase, induction motor, direct coupled to two fifty-two-kilowatt, continuous-current, shunt-wound generators, placed one at each end of the motor shaft, supplying current at about 205 volts, as balancers on the lighting system, or for starting or exciting the traction motor-generators.

Two high-tension switchboards are placed on galleries, one at each end of the main bay, and two low-tension switchboards are placed on galleries along the front side of the main bay, both being used for traction and lighting respectively. The high-tension boards are arranged in three tiers. On the lower or basement level are placed the sealing and dividing boxes, into which are brought the high-tension feeders from the power station, the spark-gaps, feeder and motor duplex fuses, field-regulating resistances, liquid starters, and stator transformers for the induction motors. On the main platform are placed the switch panels with all the necessary instruments. The third or upper gallery carries the duplicate high-tension bus-bars and selector switches. Means are provided for interconnecting the bus-bars of the two boards, so that traction sets can be run from lighting feeders and *vice versa*. The low-tension boards are arranged in two tiers, the various resistances and starters being placed on the basement level, but, as in the case of the high-tension boards, they are operated from the main gallery. The high-tension cablework in the station is almost entirely three-core, armored throughout, cleated to the floor and run in earthenware pipes through the beds where necessary, suitable tail-end boxes being provided at the terminals.

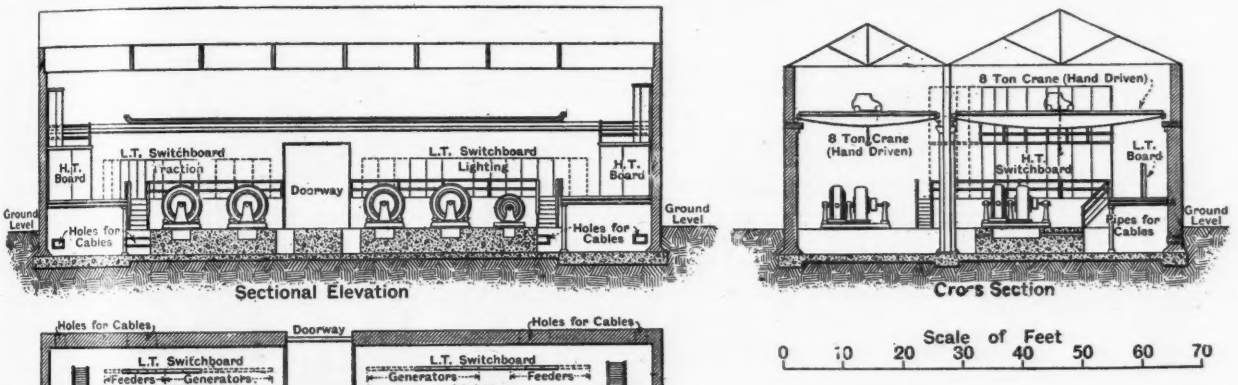


FIG. 3.—MANCHESTER CORPORATION ELECTRICITY WORKS, POLYGON SUBSTATION.

A—6,500-Volt, Three-Phase Motor; B—500-Volt, 220-Kilowatt, Direct-Current Generator; C—200-Volt, 220-Kilowatt, Direct-Current Generator; D—50-Kilowatt Generator.

The second type of substation is represented by "Oldham Road," which is typical of the second ten stations; with the exception of two, all are arranged for both lighting and traction. Each station is arranged in one bay, with the high-tension switchboards on one side and the low-tension on the opposite side, the machines being placed in pairs down the centre, provision being left at one end for considerable extensions. The equipment, consisting of synchronous and induction motor-generators, is very similar to the previous type, their outputs varying from 250 kilowatts to 104 kilowatts. The low-tension generators of each set are, however, compound-wound, and are, therefore, available for either lighting or traction purposes. A saving in spare plant and space is thereby effected as against the use of separate sets for each purpose.

The main switchboards are placed on galleries nine feet above floor level. The high-tension board controls the incoming and outgoing feeders and the synchronous motors, and is provided with two sets of bus-bars to which the lighting and trac-

[1] Paper read before the Incorporated Municipal Electrical Association, June 30. Slightly abridged. Illustrations reprinted from *Electrician* (London).

tion feeders are respectively connected. But as each motor is provided with a change-over switch, and can therefore be run off either set of bars, the arrangement is practically equivalent to a "duplicate set." Frequently lighting and traction sets are run off the same bus-bars, and the varying load of the latter has not been found to interfere with a steady voltage being obtained from the former. This would appear to raise the question as to whether separate lighting and traction bus-bars are really a necessity. Under the main gallery and on the floor level are placed the various resistances, starters and feeder charges, the first consisting of three separate water tanks, forming a non-inductive resistance. This arrangement has been found preferable in every way to the choking coil or separate motor-generator type.

A cable subway runs the whole length of the building on each side, and receives the high and low-tension cables as they come in from the streets, and also carries the machine leads. The latter are single conductor cables throughout, drawn through Doulton ducts between the machines and the subways.

STATIC TRANSFORMER EQUIPMENTS (BEYER-PEACOCK'S).

Fig. 5 shows the general arrangement and diagram of connections of a substation recently equipped by Beyer, Peacock & Company, Gorton, Manchester. The transformers are of sixty-kilowatt capacity, six of these being banked together in "mesh" to form two groups of 180 kilowatts each. The ratio of voltage is 6,500-220. They are of the natural ventilation type. The switchboard is of the multi-frame order, and has panels controlling the two high-tension feeders, two high-tension transformer panels and two low-tension distributing panels. The current is metered on the primary side of the transformers, and a recorder is fixed on the low-tension panels reading direct in horse-powers. Provision is made for extension, the above installment representing rather more than one-third of the capacity of the works. The efficiency of the transformers has been guaranteed for 98.5 per cent at full load, with a drop of not more than four per cent when working on any power-factor.

WORKING OF SUBSTATIONS—STARTING UP.

(*a*) Rotary Converters—There are three possible ways of starting up a rotary converter:

1. From the alternating-current side by switching it straight on to the supply

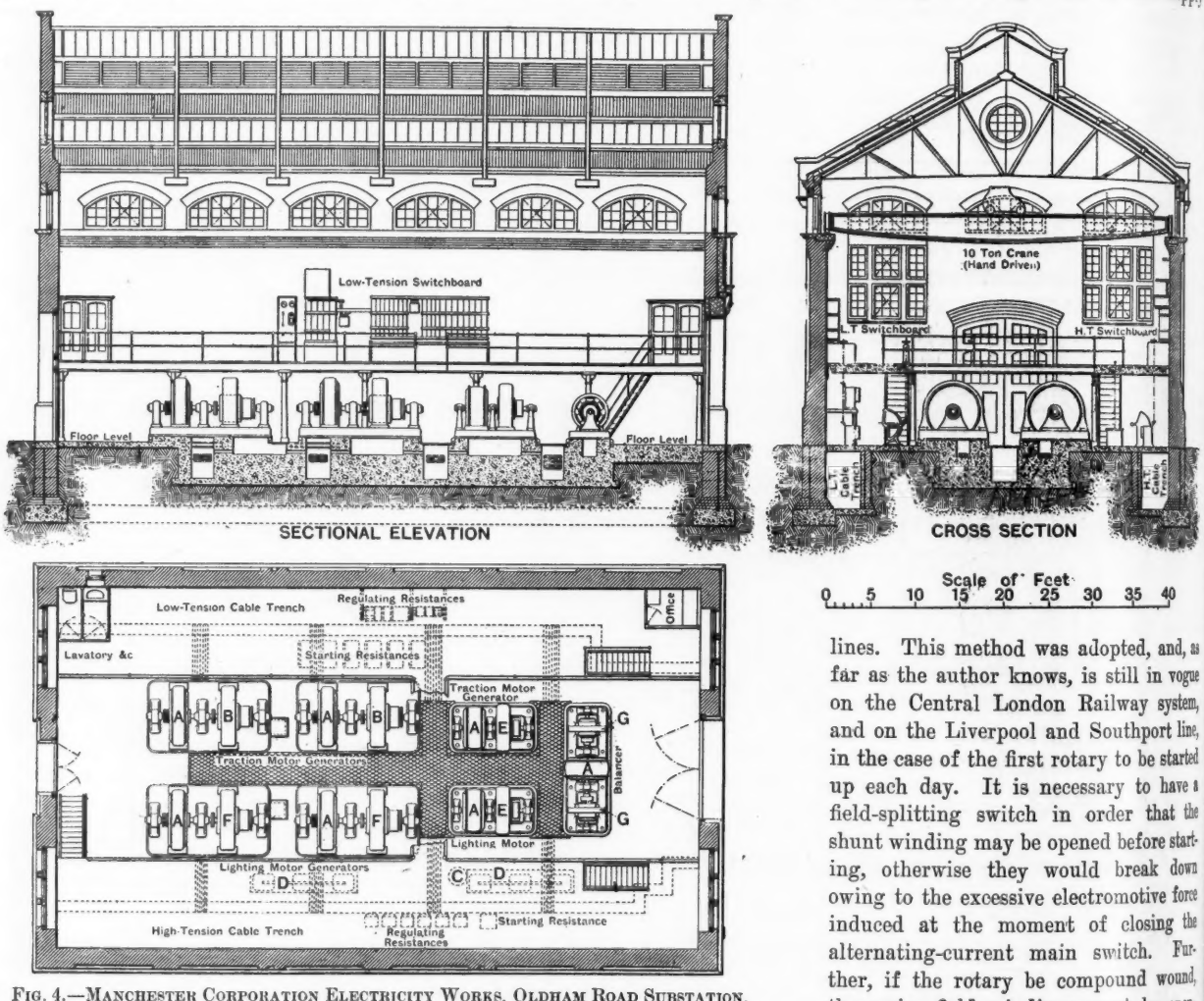


FIG. 4.—MANCHESTER CORPORATION ELECTRICITY WORKS, OLDHAM ROAD SUBSTATION.

A—6,500-Volt Three-Phase Motor; B—500-Volt, 250-Kilowatt, Direct-Current Generator; C—Stator Regulating Transformer; D—Water Resistances; E—200-Volt, 150-Kilowatt, Direct-Current Generator; F—200-Volt, 250-Kilowatt, Direct-Current Generator; G—50-Kilowatt Generator.

lines. This method was adopted, and, as far as the author knows, is still in vogue on the Central London Railway system, and on the Liverpool and Southport line, in the case of the first rotary to be started up each day. It is necessary to have a field-splitting switch in order that the shunt winding may be opened before starting, otherwise they would break down owing to the excessive electromotive force induced at the moment of closing the alternating-current main switch. Further, if the rotary be compound wound, the series field windings must be open-circuited. All switches on the direct-current side must be left open before switching the rotary on to the line. By reason of the hysteresis lag in the poles, and in a lesser degree due to the eddy currents set up, the rotary will start as soon as the alternating-current switch is closed, and will immediately run up to synchronous speed. As soon as synchronism is attained, the field-splitting switch and direct-current field switch can be closed. With self-exciting sets care must be taken to see that the latter is closed as the machine is building up on the right polarity, which can be done by closely observing the

direct-current voltmeter. If this is not done, the polarity on the direct-current side of the rotary will be reversed.

The rotary will now be running in synchronism with the main generators, and can be paralleled on the low-tension bus-bars in the usual way. Although this method may be unavoidable in some cases, it has serious disadvantages, chiefly on account of the large current at low power-factor which it draws from the supply lines, and the possibility of the rotary building up on the wrong polarity. For traction work this method may be employed, but not for lighting purposes.

or, better still, the following, third, method may be usefully employed.

3. This consists in coupling on to an extension of the rotary shaft a small three-phase, low-pressure, induction motor, the capacity of which should be approximately one-tenth of the full-load output of the rotary. By means of this starting motor, the whole set may be brought up to synchronous speed, the alternating-current and direct-current fields adjusted, and then synchronizing the alternating-current side of the rotary on to the line, afterward cutting out the starting auxiliary unit.

balancers. Their value in this respect forms an additional reason, in addition to those previously set forth, why a combination of induction and synchronous motor sets is desirable. If battery power is available, this will provide the alternative direct-current supply, but it rarely happens that battery stations and polyphase substations are combined.

(*c*) A method of starting up applicable to both rotaries and synchronous motor-generators is shown in Fig. 6, and is a slight modification of the first method described for the starting up of the former. The compensator shown reduces the

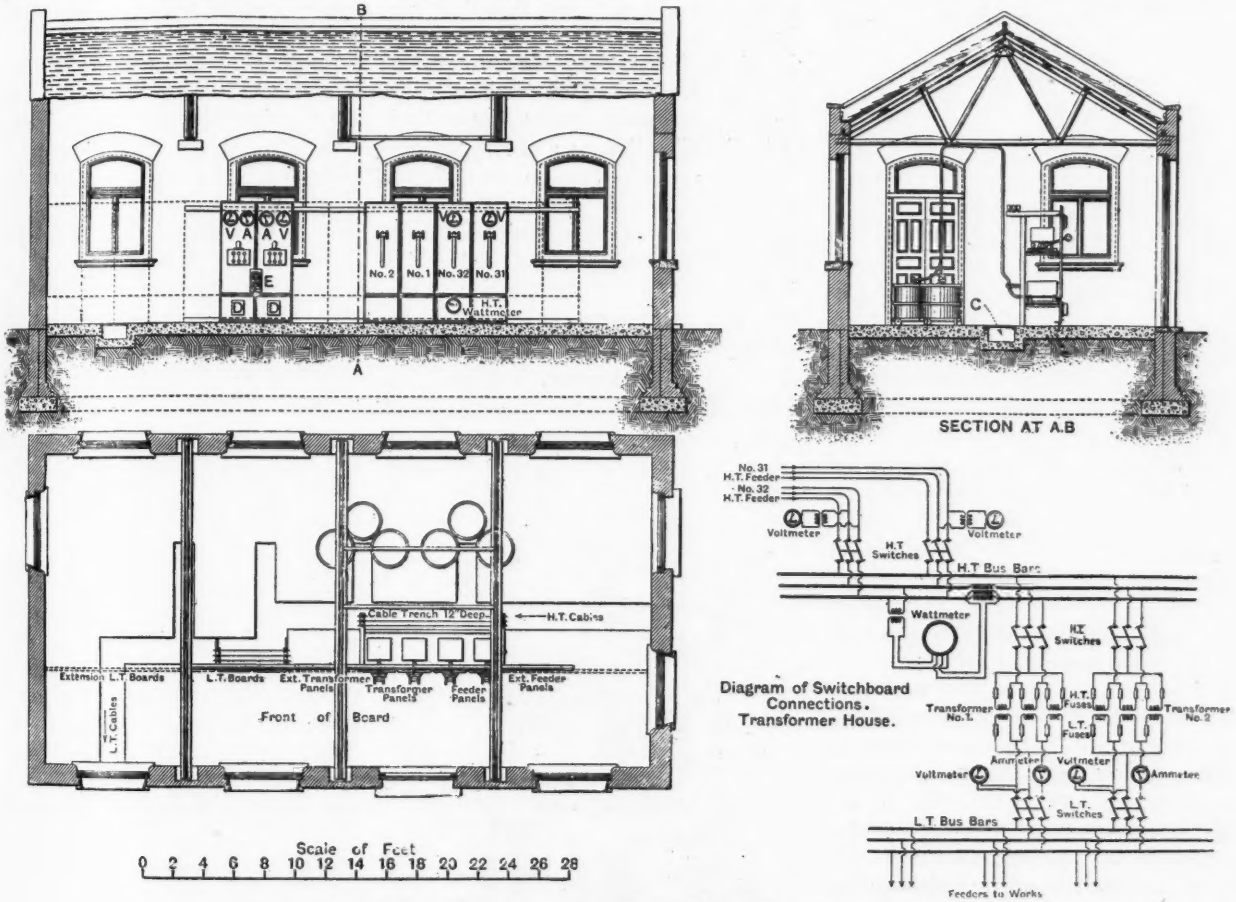


FIG. 5.—MANCHESTER CORPORATION ELECTRICITY WORKS, TRANSFORMER HOUSE.

A—Ammeter; V—Voltmeter; C—Cable Trench Covered with $\frac{5}{32}$ Inch Steel Plates; D—Fuses; E—Recording Horse-Power Meter.

2. Starting up from the direct-current side is a far simpler operation, and presents no difficulties of operation, and can usually be followed in most instances where a supply of direct current in the substation is available. In the case of the Central London Railway this method was always adopted for all sets after the first. For lighting systems the starting current required for large units might occasion a heavy drop on the distributing mains, and it will become necessary either to provide an induction motor-generator set to supply the necessary direct current,

(*b*) Synchronous Motor-Generators—The starting up of synchronous motor sets presents no difficulties, and is usually from the direct-current bus-bars, and synchronizing on the alternating-current side in the usual manner. It is, however, absolutely necessary that provision be made in every substation for the plant to be started up from the alternating-current side in the event of a possible shutdown of the lighting or traction systems. Such means are at hand in the employment of induction motor sets, which in lighting substations are frequently coupled up to the

primary voltage to one-half; the double-throw oil switch, which is fitted with an overload device, is thrown down on to the bottom contacts. Half voltage is thus impressed on the rotary or synchronous motor, and, the field switch being left open, the machine runs up on an induced field. When full speed is attained, and the field built up in the right direction, the field switch is closed, the oil switch is thrown over on to the top contacts—*i. e.*, on to the full voltage bars, and the starting high-tension oil switch is withdrawn.

The motor-generator with induction

motor is the simplest of all types of sub-station equipment to start up. With long feeders it is desirable that the pressure on the feeders should be applied gradually to the stator of the induction motor, as any throw-up in the voltage due to the capacity of the feeder at the moment of switching in might break down the insulation of the motor. A suitable design of three-phase stator starter to be

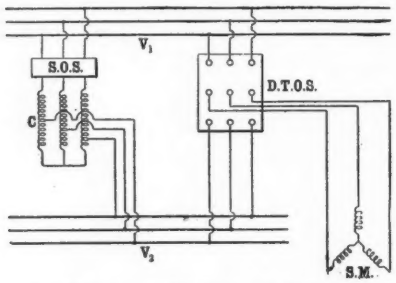


FIG. 6.—METHOD OF STARTING-UP SYNCHRONOUS MOTORS FROM ALTERNATING-CURRENT SIDE.

V_1—Full-Voltage Bus-Bars; S.O.S.—Standing Oil Switch; C—Compensator; D.T.O.S.—Double Throw Oil Switch; S.M.—Synchronous Motor; V_2—Half-Voltage Bus-Bars.

used for the purpose is shown in Fig. 7. It consists of three coils arranged in a triangle, and carefully insulated by cylinders of mica. Each coil is provided with an adjustable core consisting of a large number of iron sheets one-fiftieth of an inch thick. The three iron cores are attached to a round disc, which is held by a three-armed cast-iron holder, through the middle of which runs a screw, and the three iron cores can thereby be raised and lowered. The three coils are switched in series with the corresponding phases of the motor which is to be started up. Before switching in, the iron cores are lowered into the coils so that on first switching in only a small current goes into the stator of the motor. The cores are then gradually raised out of the coils, the inductive resistance being thereby gradually lessened, and finally the coils are short-circuited. A water resistance or other suitable form of starter is inserted between the slip-rings of the rotor, and short-circuited as soon as the set is up to speed, when the machine can be paralleled in the usual manner on the direct-current side. On account of the heavy rotor cables with large units, it is desirable, to avoid expense, that the rotor starter should be placed as near the machine as possible, and a convenient arrangement is to operate it by means of bevel gearing from the front of the switchboard platform.

EXCITING.

Rotaries are invariably self-excited for obvious reasons. There is one strong disadvantage, however, with this method, consequent on the possibility of the rotary reversing while under load. This happened on two or three occasions on the Central London Railway system, and is a possibility to be reckoned with. If the rotaries are excited from the bus-bars, then a battery connected across the bars becomes imperative. For synchronous sets employed on traction circuits, a separate exciter mounted on the end of the shaft is probably the best method of exciting the high-tension motor fields. Although it occupies extra space, it provides an alternative method of excitation from the lighting bus-bars where a mixed system is supplied. In any case, it is desirable that the excitation for the traction sets should be independent of the lighting system, and this can best be obtained by the use of a separate exciter, or a method to be described later on under "balancing." For synchronous sets on lighting networks, excitation from the direct-current terminals or light-tension bus-bars will probably be found sufficient. The author considers that the question of excitation is of importance, and should be well considered.

BALANCING.

The effective balancing of a three-wire lighting network from substations can be

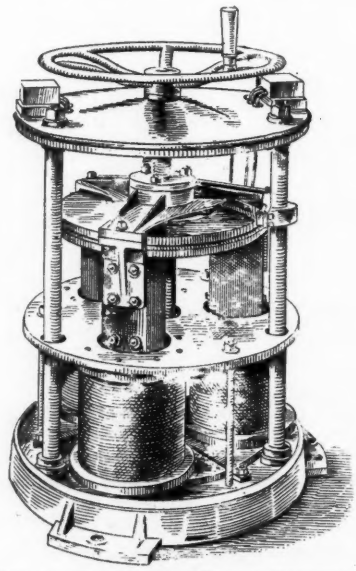


FIG. 7.—THREE-PHASE STATOR STARTER.

secured by the use of an induction motor coupled to two generators giving about half the pressure across the outers, the whole combination forming an auxiliary set for the supply of direct current necessary to start the larger synchronous units. It is, however, desirable that additional means of balancing should be provided, either by the use of double-wound armatures with the synchronous sets or other methods. An alternative arrangement has been used extensively in the Manchester substations, and emanates from the Allgemeine company. This apparatus is essentially a choking coil, the ends of which are connected up by means of two slip-rings to the armature of the continuous-current dynamo. The slip-rings are connected up to the armature at such points that a normal alternating current at the frequency corresponding to the number of pole-pieces and the revolutions is circulating in the equalizer. The middle wire of the system is connected up to the middle point of the choking coil. If the load on each of the two net-halves is unequal, the overload on one will pass through the middle wire into the respective side of the equalizer, and through the slip-ring belonging to it back into the armature. This method also provides another supply for exciting current, and if all the synchronous plant in each substation is so arranged, it is evident that each set will be self-excited. An out-of-balance current up to twenty-five per cent can be dealt with under this arrangement without the difference in voltage exceeding two and one-half per cent of the mean voltage.

HUNTING.

To ensure satisfactory parallel running and immunity from what is known as "hunting," it is necessary that every detail of the system should be very carefully considered. Troubles from this source are almost entirely associated with rotary equipments. If the frequency of the supply system be not uniform—that is, if the variations in the velocity of the main generators during one revolution exceed a definite and certain limit—the rotary converters tend to follow, and vary in accordance with the power-house generators. If these variations occur rapidly, it is impossible for the converters to keep in step, and "hunting" ensues. But this trouble can be set up independently of the power-house engines. Oscillations may be set up from a variety of causes within the rotaries themselves, which, if not checked, will spread over the whole system. It is necessary, therefore, in the first place, to provide suitably but not too well, governed engines in the power-house, and, secondly, to attach special devices to the rotaries themselves to check any oscillations that may be set up. For this purpose "damping coils" are used, which usually take the form of copper plates which bridge over the space between the pole-tips. The eddy currents produced in the latter tend to restrain or counteract

the distortion of the magnetic field due to the armature oscillations. This tendency to unstability of rotaries, however inappreciable for traction work, has, in England, at any rate in the past, placed them at a disadvantage for lighting work. With synchronous machines the author has never experienced any trouble from this source, and given suitable engines at the power-house there should be no possibility of hunting. The armature reaction of the high-tension motor is considerable, the fields being excited at a constant pressure, and independent of the feeder pressure.

SYNCHRONIZING.

It is of greater importance that the machine should be as nearly as possible in phase than at the same voltage. A synchronizer so arranged as to indicate the relative speeds of the incoming machine and those already on the load will be found a useful and time-saving device, and may be combined with the ordinary method of voltmeter and lamps. By the adoption of this type of synchronizer the machine can be synchronized in the shortest possible time and with the smallest interchange of current between the various machines.

GENERAL CONCLUSIONS.

For traction systems, very strong reasons must exist if the claims of the rotary converter operating at twenty-five cycles are overlooked. They are at least five per cent more efficient than either of the other equipments; their ability to stand considerable overloads and the high power-factor at which they can be operated outweigh the disadvantages pointed out in the earlier part of this paper.

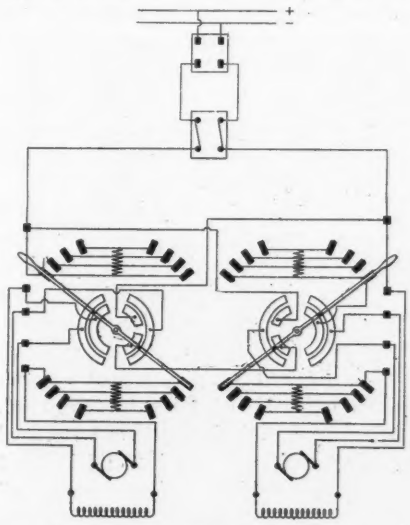
For mixed lighting and traction, lighting considerations will probably settle the type of equipment, and for this synchronous motor-generators operating at fifty cycles appear to best fulfil the majority of conditions required—*viz.*, ease of regulation of direct-current pressure, satisfactory parallel running, little or no variation in pressure; in short, they are not so sensitive as rotaries and they can also be worked at an equally high power-factor. It is possible that the disadvantages of the rotary are sometimes exaggerated. Their large use in the States and increasing use in England point to the fact that under special circumstances their adoption may be deemed warranted.

In the case of direct-current lighting and power systems, most difficulty will, perhaps, be experienced in deciding on the respective merits of synchronous *versus* induction motors. As mentioned before, the drawback to the latter is the fact that the current is always a lagging current, and the smaller sizes have a relatively low power-factor. There is also a gain of one to two per cent in efficiency in favor of the synchronous type, to balance which may be placed the extra complications in switch gear. For units of 500 kilowatts and over the author considers that either type might be usefully employed, the increased cost of the induction type being balanced by the increased cost of switch gear with the synchronous type. For units of less than the above output, a combination of both types has worked with advantage, the leading currents of the one compensating for the lagging currents of the other, while the induction motors provide the necessary means of starting up the substation from the high-tension side in the event of failure on the direct-current side of the system.

In conclusion, the author would take this opportunity of expressing his thanks to those representatives of the British Thomson-Houston Company, the British Westinghouse Company, the Electrical Company and Dick, Kerr & Company, who have kindly placed data at his disposal.

An Electrical Quick-Return System.

Richard H. Stevens and Samuel S. Wales, of Munhall, Pa., are the inventors of an electrical quick-return system relating to devices for adjusting the movable roll or rolls of rolling mills, designed to reduce the time interval in restoring the roll to its original position, after a piece has been rolled and preparatory to starting in the next piece, and thereby increasing the output of the mill. In carrying out the invention, a lower stationary roll, an upper movable roll and adjusting screws having squared shafts engaging worms on a common shaft are employed. This shaft has a belt connection with another shaft, having a toothed wheel engaged by the pinions of two electric motors. These motors are so connected that when the controller is actuated to move the screws downward the motors are in series, whereas when the controller is reversed to move the roll upward, they are placed in parallel and their power and speed thereby greatly increased, giving a quick return movement to the roll. The following system of connections is employed for shifting the electrical connections. From the field coil of a motor a line extends to the resistances of a reversing controller, the other line extending to the general negative line through a connection. From this connection the wire leads to the inner ring-segments of the other reversing controller. From the motor brushes of one of the motors a line leads to the reversing ring of one of the reversing controllers which is connected, through the usual connecting controller-arm, with the resistances of the reversing controller. From the other brush a line is connected to a ring, which is connected by the other arm of the reversing controller to another resistance. The controller arm is in three sections, insulated from each other. In the connections for the other motor, a line from the field coil extends to the central ring section of the reversing controller, while the other line extends through the set of resistances. The connection from one brush of this motor leads to the outer reversing ring, while the other connection leads to the other ring. The reversing arm is divided into three sections, insulated from each other. The lower section connects to the first contacts of the lower resistances. The central portion contacts with the inner ring, the segment, from which the connection extends to the corresponding segment ring of the other controller, being the companion segment therein. In the reverse position the central portion makes corresponding connection between the two segments. The third section connects one segment to the first of the upper resistances from which the wire extends to the main line. This main line wire is also connected to the segment ring of the first controller. When the arms are so positioned that the motors are in series, this position and the successive positions thereafter are used to screw down the upper roll to the desired points. After the piece has been rolled, the connected arms of the two controllers are reversed, when the direction of the current is reversed and the motors are placed in parallel, thus giving greatly increased power and speed, which will quickly return the screws to their normal position, the mill then being ready for the next piece of metal.



ELECTRICAL QUICK-RETURN SYSTEM.

Power Equipment of the New Shops of the Mexican Central Railway Company, Limited, Aguascalientes, Mexico—II.

(Concluded.)

By R. M. Henderson.

PIPING.

As a rule the piping of a power plant is the last part of the apparatus to be considered, and all too frequently it does not receive the careful consideration that is given to the so-called more important parts. In the belief that there is nothing about a plant of more importance than the steam piping, the specifications covering this branch of the work were very carefully drawn. The general arrangement can be better shown in Figs. 8 and 9 than described, but the general character of the materials and workmanship required is better illustrated by description of the work as done under the specifications.

All pipe for high-pressure steam is of "extra heavy" wrought iron, of National Tube Standard, while the piping for exhaust steam, water, air, oil and drips, unless otherwise specified, is of full weight, black iron pipe, of National Tube Standard. All of the water and air pipes which are run underground are of cast iron, nowhere less than one-half inch thick, with bell and spigot connections and joints calked with lead.

All fittings for live steam, pressure feed water and the high-pressure drip piping are of "extra heavy" cast iron, flanged or screwed, as best suited to each case. Fittings for exhaust steam, water and air pipes are of standard weight, cast iron, flanged or screwed, as required, except where located in the ground. All flanged or screwed fittings were required to be equal in weight and quality of material and workmanship to the standards of Crane & Company, or the Eaton, Cole & Burnham Company. The valves used in live steam, pressure feed and pressure drip return lines are of "extra heavy" pattern, with cast-iron bodies and hard bronze seats. Sizes eight inches and above are fitted with a by-pass and valve. Valves on other lines are of standard weight and pattern with cast-iron bodies and hard bronze seats. All valves used in this work are gates with flanged, screwed or bell ends, as required, and are Eaton, Cole & Burnham or Jenkins make.

The requirements at the joints were, that the taper of the threads should be such that at least two full threads be exposed after the fitting has been made up to a tight bearing, and in the case of seven-inch pipe and larger, not less than three full threads may be exposed. White lead and linseed oil were permitted only as a lubricant. Gaskets for live steam and pressure feed flanges are of corrugated copper, in no case less than No. 24 gauge, thoroughly annealed and of proper diameter to come within the bolt circle. Gaskets for exhaust steam, water and air-pipe flanges were of "Rainbow" sheet packing one-sixteenth inch thick. The whole pipe system was given a thorough running test under maximum working pressure, and the contractor was required to make good all imperfect material and leaky joints resulting from this test. The underground compressed air piping, which was rated for 100 pounds air pressure, was tested and made thoroughly tight under 150 pounds hydraulic pressure.

A full set of gauges was mounted on a marble panel in the engine room. The instruments have eight and one-half inch dials and are mounted in heavy brass cases. Two high-grade Tagliabue angle thermometers are installed in the boiler feed line, and one in each boiler feed pipe just below the check valve. These thermometers are mounted on the two test boilers and give the temperature of the entering water either from the main feed line or the test feed line. A third thermometer is located near the discharge from the test feed pump, so that the actual work done by the feed-water heater may be noted at a glance.

All live steam piping is lagged with "fire felt" material, manufactured by the H. W. Johns Manufacturing Company. All such piping, six inches and above, has a first covering of fire felt sheets, one inch thick, closely wired to pipes and is finished with a coat of asbestos cement one-half inch thick, troweled hard. Pipes less than six inches have a sectional covering of fire felt one inch thick, fitted closely and held with brass bands, all joints being left tight. After all the covering was finished, it was given a coat of glue sizing and two coats of first-class lead and oil paint.

The high-pressure steam piping consists of a twelve-inch main header for the superheated steam and a three-inch auxiliary header for the saturated steam. The eight-inch take-off pipes from the boilers to the main header are of large radius bends, and in addition to a gate valve there is an automatic explosion valve in each boiler line. The main header is cut into sections by gate valves. The steam connections to the turbines are also of long radius bends. Through a reducing valve, steam is admitted to a low-pressure main which supplies all the other apparatus except the injector and the main boiler feed pump. These latter are supplied with saturated steam at full boiler pressure from the auxiliary steam header. This auxiliary header also supplies steam through a reducing valve to the low-pressure steam main. All expansion and contraction of piping is provided for without the use of any form of expansion joints. The exhaust piping from the turbines is of spiral riveted pipe and has connection to the condenser or to free exhaust. An automatic relief valve protects the system. All other exhaust pipes connect to the feed-water heaters and an auxiliary riser is provided for free exhaust in this line also. Provisions have been left for future extension in the way of additional feed pumps, a fire pump, and additional air compressors. At the hot well there is a ball cock in the water supply line entering the well which assures a constant water level in the well. Branch pipes from the boiler blow-off cocks connect with a three-inch main which discharges into a blow-off well, communicating directly with the sewer. Each branch blow-off pipe is supplied with an extra heavy guard valve, in addition to the usual blow-off cock, and the piping is so arranged that the boilers may be completely drained of water when required.

A complete system of high and low-pressure drip piping, with steam traps, made by the Nason Manufacturing Company, of New York, returns all condensation to the hot well.

A six-inch main pipe is laid in a duct below the surface of the engine-room floor and connects the air compressors to an air receiver four feet in diameter and ten feet long outside the building. A one and one-quarter inch pipe taken from the top of the air receiver is carried to the engine room and a connection is made near each generator for cleaning. Starting at the air receiver a system of distributing piping is laid through the yard for the general distribution of compressed air for use in shops and yard. Six additional receivers are located at different

points on the line, serving the double purpose of collecting the condensation and of maintaining a good line pressure against sudden local demands. As before mentioned, these pipes are of cast iron, bell and spigot ends, lead-calked and set twelve inches from the surface of the ground to the top of the pipe. At all corner turns in the air piping plugged tees have been used instead of elbows. The receivers used are of steel plates for 120 pounds working pressure and are six feet in diameter and twelve feet long.

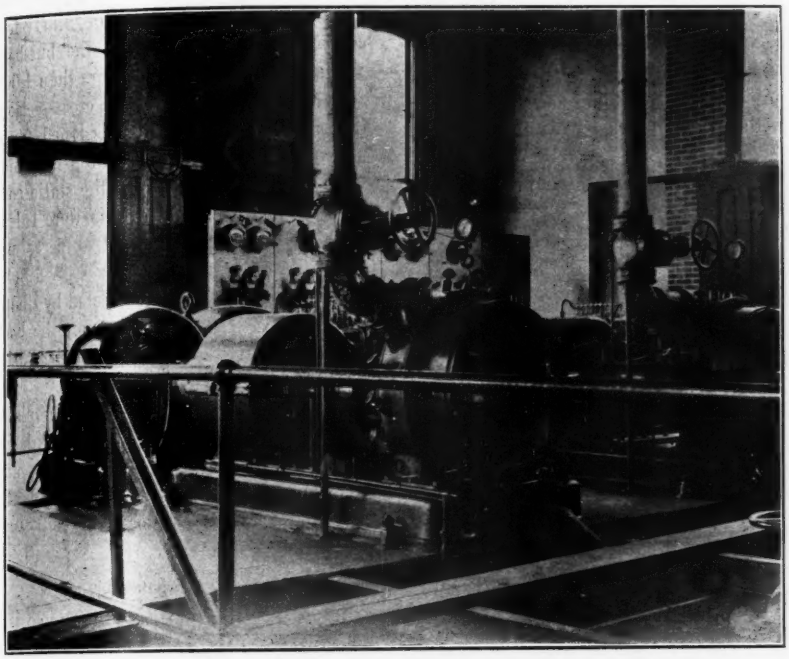


FIG. 8.—ENGINE ROOM, TURBINE GENERATOR FROM THE TURBINE END.

DYNAMOS.

The dynamos are of the double-armature type as built by the Milwaukee Electric Company, for direct connection to De Laval steam turbines. The armatures are mounted by pressure fit on their own shafts, a flexible belted coupling connecting them to the turbine main shafts. Each side of the double machine is a compound-wound, four-pole, direct-current, 100-kilowatt generator, overcompounded ten per cent, with a working range of electromotive force from 250 volts at no load to 275 volts at full load. This rather high overcompounding was specified on account of several comparatively long lines to points where there is a considerable consumption of power. Excellent results have been obtained. The shunt and series coils are separately wound and independently insulated, and are slipped over the laminated pole-pieces before bolting to the frame. The armatures are of the iron-clad, bar-wound, ventilated type, the core being built up of thin double annealed steel laminations. The commutator is of exceedingly heavy construction and is so arranged as to be mounted directly on the armature spider. The machines were guaranteed to run continuously at full load with a temperature rise on field and armature coils not exceeding forty degrees centigrade above the surrounding atmosphere, and forty-five degrees centigrade on the commutator. Under twenty-five per cent overload for two hours five degrees centigrade additional rise was allowed, and the dynamos are to stand temporary overloads of fifty per cent without injury to any part. The commutation is excellent, as, without shifting the brushes, there is no sparking from no load to twenty-five per cent overload. The guaranteed efficiencies are ninety-two per cent at full load, 88.5 per cent at half load, and eighty-one per cent at quarter load. The current output of each generator set is 800 amperes at 250 volts, or 400 amperes at 500 volts, making the maximum output of the station twenty-five per cent overload, 1,500 amperes at 500 volts.

DISTRIBUTION SYSTEM.

In deciding on the system of electrical distribution and control as related to the driving of machine tools, all due consideration was given to the manifold advantages of multiple voltage with several available voltages. However, to obtain the best results which one has a right to expect from such a highly developed and relatively complex system it is preferable, if not absolutely essential, that the machinists operating the tools be of as relatively as high an order as the apparatus. In a shop where probably seventy-five per cent of the men operating machines are necessarily common Mexican laborers—many of whom can not write their own names and are about the mental equals of the uneducated negro—it is exceedingly doubtful if it would be advisable to install multiple voltage with all its refinement of controlling apparatus. Induction motors in their extreme simplicity seemed ideal and were considered. But their adaptability to crane and other variable speed work was a much mooted and still open question. After carefully balancing the advantages and disadvan-

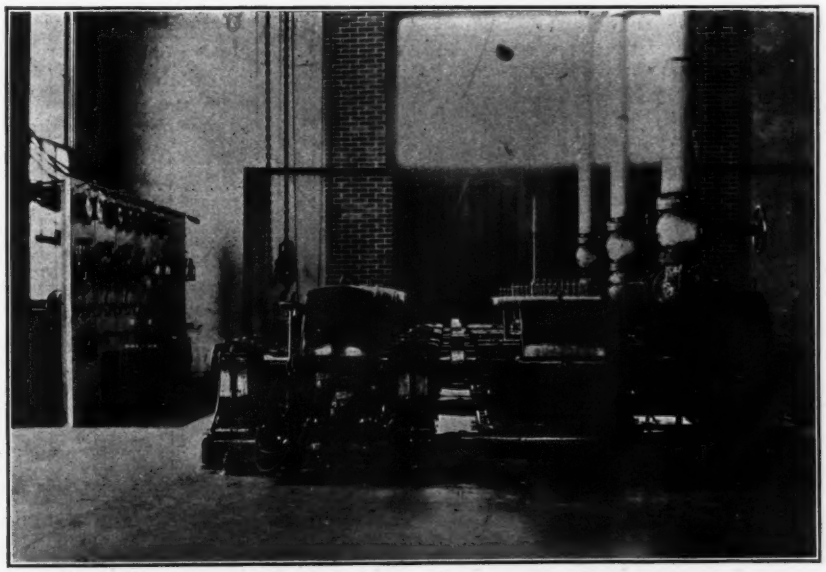


FIG. 9.—ENGINE ROOM, 300-HORSE-POWER DE LAVAL TURBINE, AND SWITCHBOARD.

tages of all the available systems together with their widely differing costs of installation and maintenance, it was finally decided to adopt the familiar Edison three-wire system with 250 and 500 volts, direct current. De Laval turbine generators, with their two armatures driven by one turbine shaft, are admirably adapted for this work. On all individually driven tools where variable speed was desired, compound starting and regulating rheostats were used in addition to the two voltages, and the motors were so connected to the tools as to preserve the variable speed features of the machines themselves. For instance, in the case of a forty-eight-inch engine lathe, the motor is geared to the countershaft whose five-stop cone is belted to the lathe. With the two voltages and the five steps of resistance which can be cut into the field circuit and the five-stop cones, this machine has fifty different and easily available speeds.

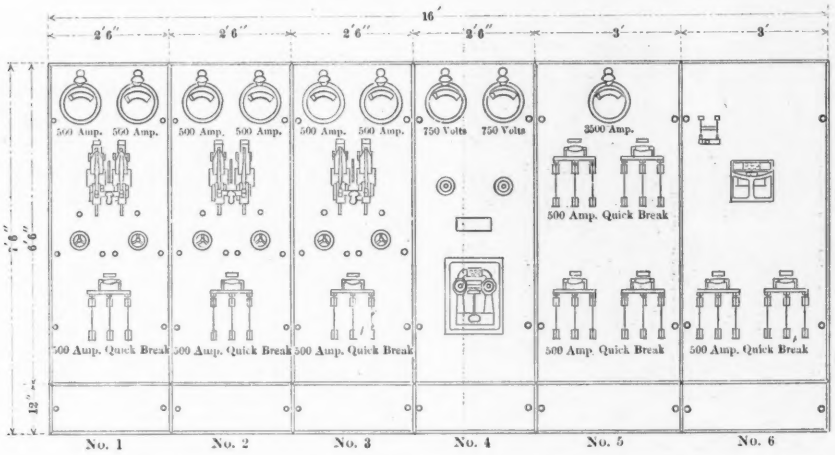


FIG. 10.—PLAN OF SWITCHBOARD, AGUASCALIENTES POWER PLANT.

The change from 250 to 500 volts or *vice versa* is made by means of an ingenious switch designed by Mr. Leslie Griscom, and the field resistance is controlled by the regular starting lever.

The smaller machines are driven in groups by constant-speed motors. As mentioned later, the distance from electrical supply houses rendered it advisable to have the fewest possible sizes of motors consistent, in order that the stock of repair parts be as small as possible.

SWITCHBOARD.

The switchboard is a handsome one of six panels of two-inch blue Vermont marble. The panels are of a uniform height of six feet six inches, and surmount twelve-inch marble baseboard panels. Beginning at the left (see Figs. 8, 9 and 10) are the three generator panels thirty inches wide, the voltmeter panel thirty inches wide, and the two feeder panels thirty-six inches wide. The generator panels each carry a 400-ampere, double-pole, laminated type I-T-E circuit-breaker, a 500-ampere, triple-pole, quick-break main knife switch, two 500-ampere Weston round type switchboard ammeters, and two Wirt field rheostats. The voltmeter panel contains two 750-volt Weston round type voltmeters, and two twelve-point voltmeter switches for connecting the voltmeters to any circuit or the ground as desired. Thus no other ground detector is needed. On this panel is also mounted a 2,500-ampere Thomson recording wattmeter for recording the total station output. The next panel is a feeder panel and contains four 500-ampere, triple-pole, quick-break switches, and the total load ammeter, a 3,500-ampere Weston round pattern. These four switches control all the shop power circuits and the separate circuit for the sixty-ton cranes in the erecting shop. The last, also a feeder panel, was added later and contains two 500-ampere, triple-pole, quick-break knife switches, one seventy-five-ampere, double-pole carbon-break knife switch and a 300-ampere Thomson recording wattmeter for recording the consumption of power by the timber-preserving plant. The seventy-five-ampere switch controls the circuit of the two thirty-horse-power motors of the condensing plant. One of the 500-ampere switches is for the line to the timber-preserving plant, and the other is for the future lighting feeders.

The board is designed for future extension, at both ends, and has bus-bars running its entire length. All copper used is hard drawn or rolled, of ninety-five per cent conductivity, and the bus-bars are designed to carry not more than 1,000 amperes per square inch cross-section. Sliding contacts were all designed for a carrying capacity not exceeding fifty amperes per square inch, and the static contacts of connectors and bolts were calculated on the basis of 150 amperes per square inch.

The switches are all connected by Shawmut enclosed fuses mounted on the back of the board, so located as to be easily accessible.

Engraved lacquered brass name-plates are mounted on the board, properly designating the generators and feeders, and each panel and instrument is individually lighted by an incandescent lamp supported by an ornamental bracket.

CRANE.

Traversing the entire engine room is a ten-ton crane, built by Maris Brothers, of Philadelphia. The span is thirty-six feet five inches between centres of runway rails, and the lift is twenty-two feet three inches. The bridge is built of two-plate girders with the track for the trolley secured to their upper flanges. The truck wheels are of open-hearth steel turned to fit the fifty-six-pound rails which are mounted on the runway girders, and fitted with roller bearings carried in brass baskets. The trucks are of steel channels. The trolley runs on cast-iron wheels with roller bearings. The load is carried on two strands of chain and is held at all points, both in hoisting and lowering, by an automatic switching brake. Hoisting is of two speeds, one doubles the other, the change being effected by a shackle on the lower block.

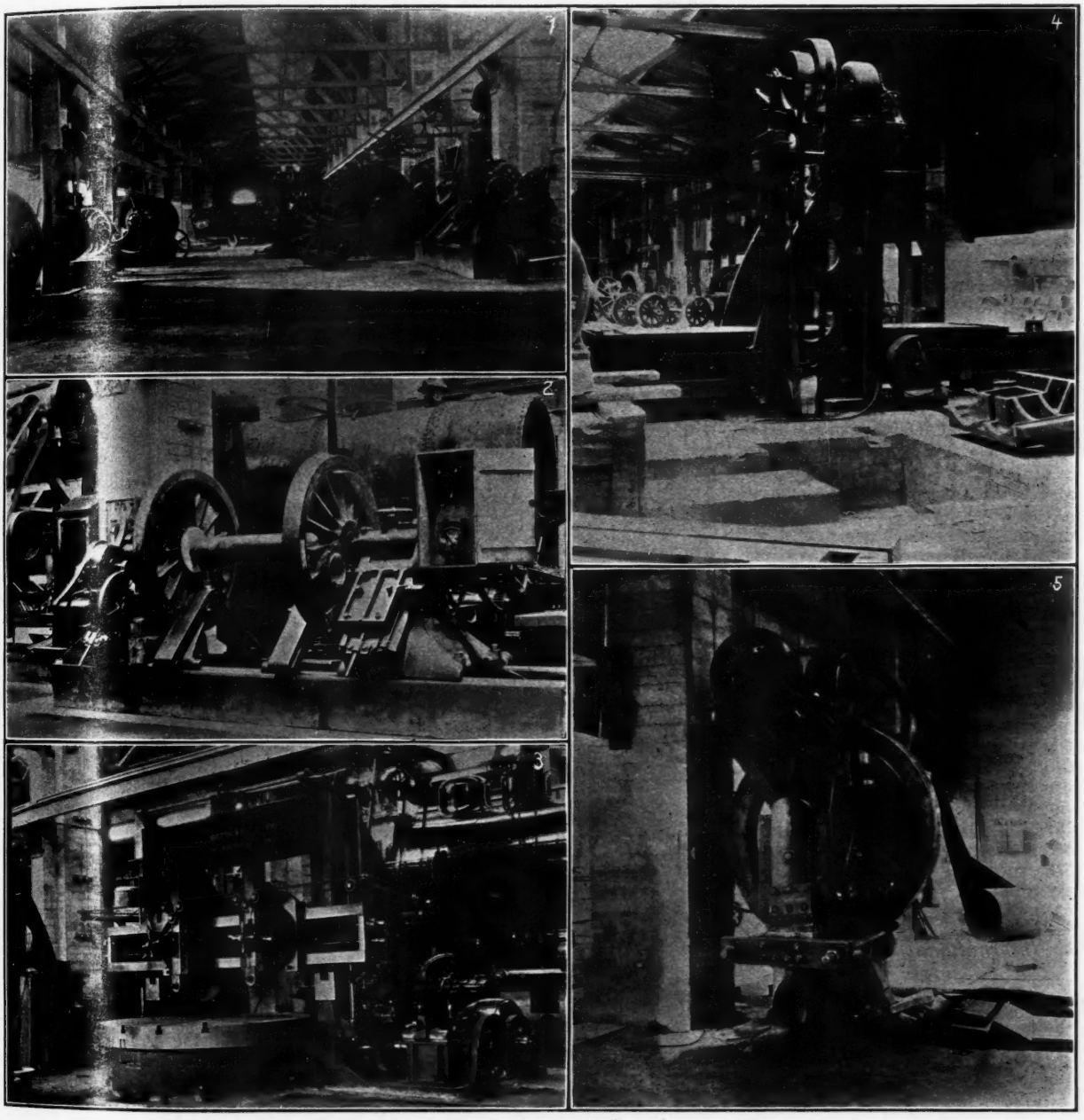
All the movements are by hand and the

Feeder No.	Size.	From Switchboard to	Total Rated Horse-Power on Line.	Approximate Distance from Switchboard to Entrance Board.
				Feet.
1	400,000 c. m.	Machine shop	331	350
2	No. 000 B. & S.	Hammer and smith shop	135	200
3	500,000 c. m.	Brass foundry	15	300
		Rolling mill	20	470
		Iron foundry	50	720
		Pattern shop	10	1,140
		Planing mill	175	1,350
		Paint shop	20	1,600
4	No. 2 B. & S.	Cranes in machine shop	30 2½	350
5	250,000 c. m.	Truck, wheel and axle shop	35	1,350
		Timber preserving plant	125	3,200

gearing is such that one man can handle the full load at sixty feet a minute on the trolley, forty feet a minute on the bridge, and three men can lift full load one foot per minute or one-half load two feet per minute.

POWER DISTRIBUTION.

From the switchboard, five lines of feeder cables distribute the electrical power. The lighting system is still in the future and will be controlled by separate feeders leading from the power bus-bars. The only exception to this is the timber-preserving plant which has its lighting system fed from the power lines; 250-volt, enclosed arc lamps and 250-volt, incandescent lamps, burning singly, are to be used throughout. Running the lighting system from the power bus-bars will not result in flickering lamps if the turbine regulation continues in its present perfection, for lights have been tried at various points of the system and no flickering was noticeable.



FIGS. 11 TO 15.—(1) GROUP OF INDIVIDUALLY DRIVEN HEAVY MACHINES; (2) MOTOR-DRIVEN QUARTERING MACHINE; (3) MOTOR-DRIVEN BORING AND TURNING MILL; (4) MOTOR-DRIVEN FORTY-EIGHT-INCH PLANER; (5) MOTOR-DRIVEN DOUBLE PUNCH AND SHEARS.

A table covering the feeder system is given on page 268.

Double-braided weatherproof wire is used for the aerial lines; and for open wiring in the buildings slow-burning, double-braided weatherproof wire is used. All conduit wiring is done with double-braided, rubber-covered wire and where run in tile ducts paper-insulated wire covered with lead is employed. All conduit work is installed on the single-tube system with loricated iron conduit. Porcelain wall bushings are used at all entrance points, and the wiring is all in accordance with the rules and requirements of the National Board of Fire Underwriters, of the United States. Overhead wires are carried on iron poles at a height of twenty to twenty-five feet from the ground. Poles are spaced about eighty feet apart and are set five feet deep in a bed of cement eighteen inches in diameter and about eight inches above the ground. This was done

to prevent the rusting away of the pole at the ground line. Iron brackets and No. 2 Knox glass cable insulators carry the heavy cables. All sizes above No. 2 B. & S. are of stranded wire. Wirt non-arcing lightning arresters are used at all entrances to buildings, and a thorough ground was made at all points where needed, either on the pipes of the water system or with heavy ground plates well buried in coke.

The wiring on entering the building is carried to a fused quick-break knife switch located at a convenient point and from this switch the branch wiring radiates to the various motors. The machine shop is typical of all the buildings in this respect. The mains are carried to the entrance board and from there the three-wire branch mains are run open in a loop around the shop, being supported by the lower chord of the roof trusses of the side bays. Branches to the machines are carried in conduits down the columns of the building to the motor panel-boards. Wires are then run in conduit to the motor.

Group motors are all run at constant speed on 500 volts. Individual motors are in some cases run on either 250 or 500 volts. All motors for machine tools are Crocker-Wheeler, open frame or semi-enclosed, shunt or compound wound, as suited to each case. (See Figs. 11 to 15.) Starting boxes and compound starting and regulating boxes were made by the Cutler-Hammer company, and the circuit-breakers which are used on all motors above fifteen horse-power are of the Cutter Company's I-T-E street-car type.

In all cases the motor-controlling apparatus is mounted on a slate panel-board of neat and substantial appearance. The panel-boards for the variable speed motors carry an auxiliary interlocking switch, by means of which the voltage impressed on the armature may be changed from 250 to 500 or *vice versa*. A non-inductive resistance is cut into the motor circuit by the act of opening the main switch so that the motor is protected during the change from one voltage to the other.

The International Electrical Congress.

The committee of organization of the International Electrical Congress has issued a new bulletin containing the programme and special notices to congress members.

The congress will convene at the music hall of the Coliseum, St. Louis, at 9.30 A. M., Monday, September 12. The Coliseum is situated at Olive and Thirteenth streets, in the city district of St. Louis. It is intended that after the opening ceremonies the convention will immediately divide into sections, the section halls being on the second floor of the same building. The bureau of information and the secretary and treasurer will also be in the Coliseum Building. On Tuesday, Thursday and Friday the sections will meet on the second floor of the Coliseum from 9 A. M. to 1 P. M.

The committee of organization of the congress was appointed by the president of the St. Louis Exposition in June, 1903. The committee held its first meeting in August, 1903. In response to invitations to join the congress, 1,915 acceptances have been received, of which 1,542 are from North America, and 373 from other countries. Over 1,300 certificates of membership have been issued to persons who have already become members by forwarding their subscriptions.

The committee of organization has issued, at the suggestion of the section officers, invitations to well-known electrical workers all over the world, asking for papers to be read before the congress. In response to these invitations about 170 papers have been promised for the congress, and sixty-seven are already in hand.

The work of the congress will be divided into eight sections, as follows: Section A, general theory (mathematical, experimental); chairman, Professor E. L. Nichols; secretary, Professor H. T. Barnes. Section B, general applications; chairman, Professor C. P. Steinmetz; secretary, Professor Samuel Sheldon. Section C, electrochemistry; chairman, Professor H. S. Carhart; secretary, Mr. Carl Hering. Section D, electric power transmission; chairman, Mr. Charles F. Scott; secretary, Dr. Louis Bell. Section E, electric light and distribution; chairman, Mr. J. W. Lieb, Jr.; secretary, Mr. Gano S. Dun. Section F, electric transportation; chairman, Dr. Louis Duncan; secretary, Mr. A. H. Armstrong. Section G, electric communication; chairman, Mr. F. W. Jones; secretary, Mr. B. Gherardi. Section H, electrotherapeutics; chairman, Dr. W. J. Morton; secretary, Mr. W. J. Jenks.

At the petition of the committee of organization the government of the United States has issued invitations to the various foreign governments to send official representatives to the chamber of delegates of the congress. Up to the present time the following appointments have been announced: Austro-Hungary, Professor Charles Zipernovsky; Italy, Professor Moise Ascoli, Professor L. Lombardi, Ingenieur A. Maffezzini; Switzerland, Professor Ferdinand Weber, Professor François Louis Schüle; Norway and Sweden, Professor Svante August Arrhenius; Australian colonies, Mr. John Hesketh; Brazil, Señor Jorge Newbery; Mexico, Señor Rafael R. Arizpe; India, Mr. J. C. Shields; United States, Professor H. S. Carhart, Dr. A. E. Kennelly, Professor H. J. Ryan, Professor S. W. Stratton, Professor Elihu Thomson.

The following European societies have engaged to cooperate with the congress: the Institution of Electrical Engineers, with the following delegates, Mr. R. Kaye Gray, president; Colonel R. E. Crompton, C. B.; Professor John Perry, F. R. S.; Dr. R. T. Glazebrook, F. R. S.; Mr. H. E. Harrison, B. Sc., B. A.; Mr. W. Duddell, hon. secretary of delegation. La Société Internationale des Électriciens. Associazione Elettrotecnica Italiana; delegates, Professor M. Ascoli, president; Professor G. Grassi, vice-president; Professor L. Lombardi, vice-president; Ingenieur E. Jona. Oesterrichischer Elektrotechnischer Verein; delegate, Herr Baron Wolfgang Ferstel.

The following societies in North America have engaged to cooperate with the congress and send delegates: the Royal Society of Canada—delegates, Professor W. Lash Miller, Professor Howard T. Barnes; the American Institute of Electrical Engineers—Mr. Ralph D. Mershon, Professor M. I. Pupin and Professor C. P. Steinmetz; the American Physical Society—delegates to be appointed; American Electrochemical Society—Professor W. D. Bancroft, Professor H. S. Carhart and Dr. Louis Kahlenberg; the National Electric Light Association—Mr. George Eastman, Mr. G. Ross Green and Dr. F. A. C. Perrine; the Association of Edison Illuminating Companies—Mr. W. C. L. Eglin, Mr. L. A. Ferguson, Mr. Gerhard Goettling; the International Association of Municipal Electricians—Mr. W. H. Bradt, Mr. F. C. Mason and Mr. Walter N. Petty; the American Electrotherapeutic Association—Dr. Russell Herbert Boggs, Dr. Charles R. Dickson and Dr. James Herdman.

The United States navy department has appointed as delegate to the congress Lieutenant-Commander Joseph L. Jayne.

A general invitation has been extended by the American Institute of Electrical Engineers to British and European electrical societies to join in the circular tour, visiting the principal cities and important industrial centres en route to and from St. Louis. The circular trip will commence at Boston, September 2, or New York, September 1 and 4. Special traveling facilities, accommodations and receptions have been arranged for the benefit of the visitors.

The European congress members who desire to join the circular tour should communicate with the secretary of the American Institute of Electrical Engineers, Mr. Ralph W. Pope, 95 Liberty street, New York city, and arrange to arrive in New York not later than September 1, or in Boston not later than September 2.

Steam-Pipe Coverings.

TO THE EDITOR OF THE ELECTRICAL REVIEW:

On perusing a recent article in your columns describing some experiments on the efficiency of steam-pipe coverings by Mr. S. H. Davies, I was surprised to find that his conclusions were wholly at variance with the results, not only of his own experiments, but with some that I have in conjunction with my colleague, Professor Dalby, recently conducted upon a much larger scale, and which showed a mica covering to be superior to those of asbestos, magnesia and other compositions (remanite I have not tried as its inflammable nature renders it unsuitable). Apart from the unreliability introduced by the small scale of Mr. Davies's apparatus, the discrepancy between his conclusions and his experimental figures lies in the circumstance that, in putting the various materials in an order of merit, he has neglected the particular that they are not of equal thickness. I have, therefore, recalculated his results, computing all the values for the same thickness, *viz.*, one inch. When thus fairly compared together they come out as follows:

Material.	Thickness Used.	Calories Lost per Hour (Davies).	Ditto, if Reduced to One-Inch Thickness.
Remanite (waste silk).	3/8	60	52.5
Mica, sectional, single.	7/8	74	65
Magnesia, sectional, single.....	31/32	83	80.5
Magnesia, sectional, thick.....	1 1/2	55	82
Slag wool, sectional..	1 3/16	60	86
Asbestos board and hair felt.....	1	91	91
Morley's composite...	1 3/4	63	110
Asbestos rope with magnesia.....	15/16	118	111
Mica, sectional, double.	2	61	122
Mica, sectional, thin ..	1 1/2	74	130
Mica, sectional, thick.	2	68	136

It will thus be seen that, of the incombustible materials, mica heads the list; being on Mr. Davies's own results eighteen per cent better than magnesia. The wide discrepancy between his various figures for mica can only be due to the imperfection of the method.

SILVANUS P. THOMPSON.

Technical College, Finsbury, London, E. C., July 8.

[The article referred to by Dr. Thompson appeared in the ELECTRICAL REVIEW for June 25, 1904.—ED.]

The Johannesburg, South Africa, Lighting and Power Plant.

The plant which the Johannesburg, South Africa, corporation is having erected will have a capacity of 9,000 kilowatts. Both direct and alternating current will be furnished. The prime movers will be gas engines. The system is one very much used where the demands for current is scattered. The inner area of the town will be supplied with a direct current from a three-wire system, while the suburbs will have an alternating current from a two-phase system. The voltage on the primary will be 3,000 to a phase, and the frequency fifty; the secondary voltage will be 400 between the two outers of a three-wire system and in most places only one-phase will be available. The first portion of the electric railway will have twenty-four miles of track.

Tests of Steel for Electro-Conductivity with Special Reference to Conductor Rails.

Mr. J. A. Capp, in a paper before the American Institute of Mining Engineers, says in regard to railway power transmission, with the increased demand for power caused by heavy trains and high speeds in recent years, it was found that the usual form of third-rail conductor was inadequate to supply the current. Manufacturers, in the absence of satisfactory data, demanded rails of a degree of purity hard to obtain and difficult to manufacture. With the object of determining the factors concerned in a choice of rails, the General Electric Company has conducted a series of tests of various steels from numerous manufacturers. A rail has also been designed different in shape from the T-rail whose advantage—that of strength—is not necessary for a conductor rail, which can be made by any mill rolling ordinary stock steel. This new rail is rectangular in design, 2.5 inches wide and four inches high, and weighs ninety-eight pounds to the yard. At the bottom it is dovetailed and can easily be secured by means of fish-plates. A study of the chemical analyses and the conducting properties of the rails show that the constituent present which affects the conductivity most is manganese. For high conductivity it is necessary that this be reduced very greatly in proportion. All the other elements, while they must be present in only small percentages, may be tolerated in reasonable quantities without unduly increasing the resistance. A rail with a resistance of 6.5 times that of copper could be rolled, but would be very expensive and probably very soft. One having a resistance not greater than eight times that of copper would probably be acceptable. For this the extreme composition permissible would be: carbon up to 0.02 per cent; manganese up to 0.03 per cent; phosphorus up to 0.06 per cent; sulphur up to 0.06 per cent; silicon up to 0.05 per cent. Any overstepping of these figures would probably result in too high a resistance, therefore for resistance up to eight times that of copper, the specified analysis would be less in every case than the above figures. The above steel can easily be made in any open hearth furnace.

Ohio Telephone Association.

Plans for the formation of a national organization were discussed by the Ohio Independent Telephone Association at a meeting held at the Hartman Hotel, Columbus, Ohio, Tuesday, August 2. The object of this meeting was to devise means for more equally dividing the territory, fixing a uniform system of rates, and to provide plans for protection against competition.

There are at present about 300 independent telephone companies in the state, and the object of the association is to bring them in closer relation and, if possible, bring about a working agreement or combination.

Those present at the meeting were Frank L. Beam, president, Columbus; E. E. Knox, secretary, Portsmouth, Ohio; Ralph Reamer, treasurer and assistant secretary, Columbus; vice-presidents, R. H. Hamblin, Toledo; J. B. Hoge, Cleveland; W. F. Laubaugh, Akron; G. E. Metheany, Lima; J. B. Rhodes, Zanesville; J. C. Reber, Dayton; Dwight E. Sapp, Mt. Vernon; W. Gilbert Thompson, Lebanon; G. P. Thorp, Wilmington; executive committee, E. L. Barber, Toledo; Cyrus Huling, Columbus; J. B. Hoge, Cleveland; D. E. Sapp, Mt. Vernon.

BOOK REVIEW.

"The American Trade Index for 1904." New York. National Association of Manufacturers. Cloth. 700 pages. 6 by 8¾ inches. Price in the United States, $5.

This volume is the sixth edition of the "American Trade Index." The primary object of the book is to acquaint the importer and dealer in foreign countries with the leading makers in the United States of all classes of goods suitable for the export trade. The index contains the names of only the members of the association. There is an alphabetical list of the members in English, and an alphabetical list of the articles made by members in English, Spanish, German and French. Distributed throughout the book are slips bound in with perforated stubs, which may be utilized in securing information from the National Association of Manufacturers. The distribution is gratuitous to prominent importers and wholesale dealers and manufacturers in countries outside of the United States who are interested in purchasing or handling American goods.

Electrically Driven Mining Apparatus in Germany.

By C. L. Durand.

THE use of electrical appliances in connection with the large mining plants has already taken considerable development in Europe. Among the most modern installations of the kind may be mentioned two large mine equipments which have lately been erected in Germany. The successful working of these plants clearly shows the superiority of the electric method for use in carrying out the different operations of the mines, especially that of driving the cables which take the load up to the surface, as well as running the cars at different levels. The problem of driving the cable drums electrically has been very well solved in these two plants, and by two entirely different methods of working. The first plant uses the alternating-current system with three-phase motors, while the second employs direct current throughout. The electric outfit in both cases has been supplied by the Allgemeine Electric Company, of Berlin.

The alternating-current method of driving has been installed at shaft No. 1 of the large mines which are operated by the Harpener Mining Company, of Dortmund. The cable drum is driven by a three-phase motor and the cable serves to elevate 100 tons of coal per hour from a level 700 metres deep. It was installed for the director of the mine, Herr Moser, in order to make a practical test of electrically operated machinery for large hoisting plants, so as to have a series of data which could be applied later on in the construction of new plants of the same kind for working the different shafts. It was decided to use high-potential alternating current in the present case, the current to be brought to the plant from a distant station over a high-tension line. The use of alternating current makes the switching and regulating apparatus of a much simpler character and allows the use of liquid resistances which will stand considerable hard usage without getting out of order.

The generating station which was erected for the present mining plant is shown in one of the engravings, Fig. 1. The building contains three direct-driven alternators, each of which is coupled to a separate engine. These machines work in parallel and furnish current for operating the hoisting machinery, which is located at the surface, as well as the mine pumps which are placed in chambers below ground and at different levels. Each of the alternators is built for 550 kilowatts, running at ninety revolutions per minute. These machines deliver alternating current at fifty cycles and 2,000 volts. It may be remarked that these alternators use the new type of field construction which was brought out by the Allgemeine company; in this case the outer field casting is made especially light and is braced across by a series of steel rods. The engines are of the horizontal cross-compound type, having a capacity of 800 horse-power each.

Fig. 2 shows a general view of the motor and cable drum outfit which has been installed in a special building near the mouth of the shaft. The cable passes over a drum six metres in diameter which is mounted on one side of the motor upon the same shaft. The diameter of the cable is forty-five millimetres. When fully loaded, the charge upon the cable

FIG. 1.—GENERATING STATION OF THE HARPENER MINING COMPANY, DORTMUND, GERMANY.

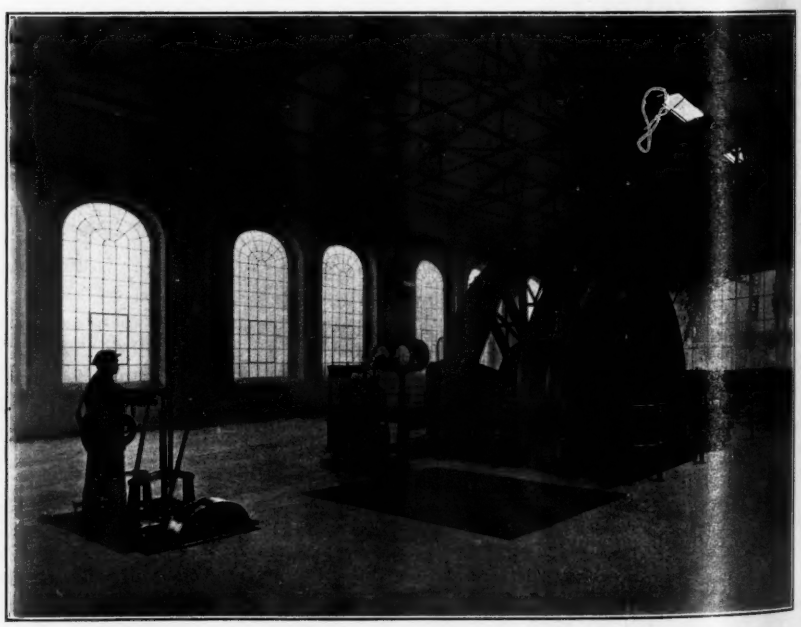


FIG. 2.—GENERAL VIEW OF THE MOTOR AND CABLE DRUM OUTFIT, DORTMUND, GERMANY.

is as follows: material carried in four mine cars at 550 kilogrammes each, 2,200 kilogrammes; elevator basket of mine, with its hangers, etc., 3,800 kilogrammes; weight of four cars at 350 kilogrammes each, 1,400 kilogrammes; weight of cable, 730 metres at 6.7 kilogrammes per metre, 4,900; total load 12,300 kilogrammes or a little over thirteen tons. The speed at which the load is driven is about sixteen metres per second; that of the cable does not exceed five metres per second.

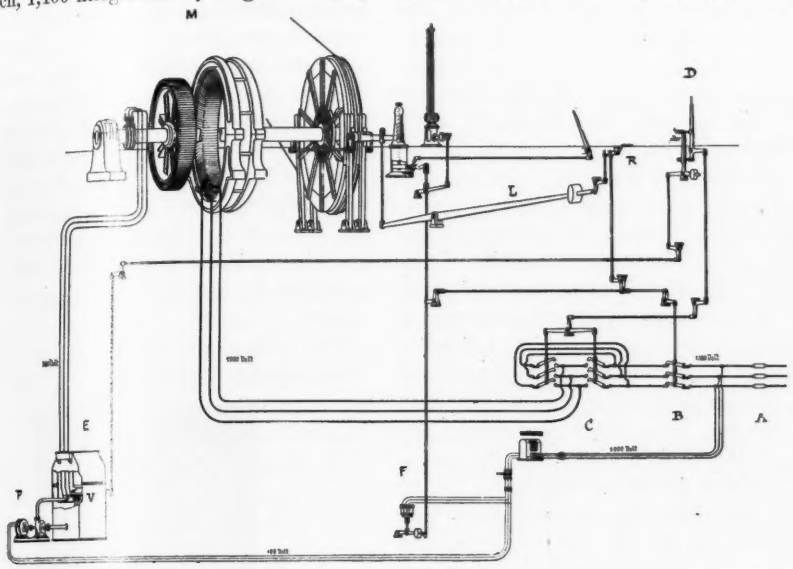


FIG. 3.—PLAN OF CONNECTIONS, HOISTING APPARATUS AT DORTMUND, GERMANY.

The motor which is used to operate the drum is of the three-phase type. The current at 2,000 volts is brought to the exterior field of the motor by insulated cables. To the left will be observed the different hand levers and pedals for operating the drum and producing the forward and reversed motion, as required, as well as working at different speeds. These operations are carried out by a series of rods and levers, connected with different mechanical devices and also with the electrical part of the apparatus, as shown in the diagram, Fig. 3. The current coming from the central station passes first through the high-potential safety fuses A and afterward through a three-pole emergency switch B. At C is an appliance for reversing the current in the motor circuit. The reversing switch is connected by a series of rods and cranks with the main operating lever D of the motor. In the middle position of the operating lever the current is switched off and the motor comes to a stop. Throwing the lever to one side or the other sends current into the motor field in different directions and causes the forward movement or reversal of the motor. The starting and speed regulation of the motor are carried out by using a liquid resistance apparatus which is placed in the armature circuit.

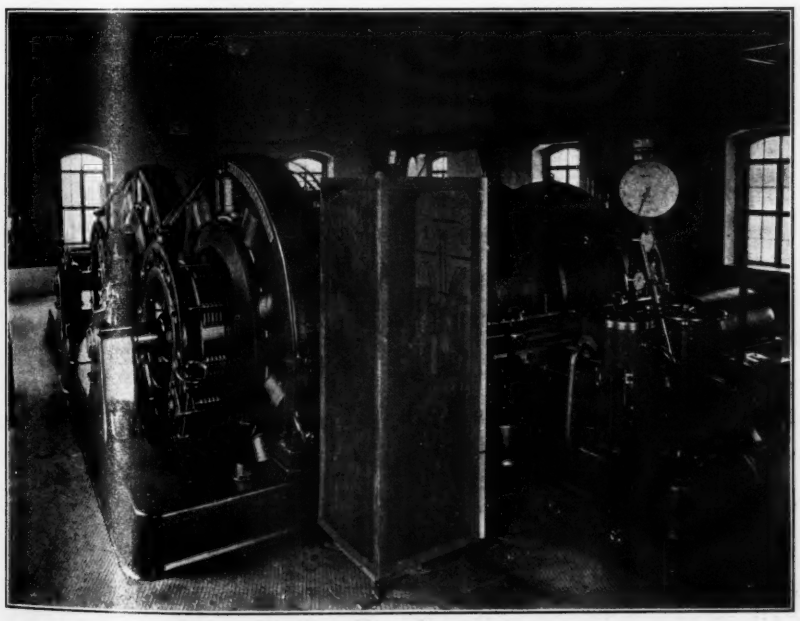


FIG. 4.—ELECTRICAL MINING INSTALLATION AT PLANITZ, NEAR ZWICKAU, GERMANY.

Each of the three phases of the armature circuit is taken from the motor M by a three-ring collector fixed on the shaft. The resistance apparatus E consists of an insulated tank which contains three electrodes suspended from the upper part. One of the armature cables comes to each of the electrodes. The lower part of the tank contains a soda solution, whose height can be controlled by the action of a motor-driven pump P, combined with a valve V which admits a greater or less quantity of liquid to the part between the electrodes. By operating the valve from the controlling lever, the liquid is made to rise gradually between the electrodes. A small current is now allowed to pass in the circuit, causing the motor to start up. The liquid continues to rise toward the top, finally bringing the motor up to its maximum speed. At the latter point an overflow orifice is provided for the liquid, so that the speed can not be exceeded.

The valve of the tank is operated from the main lever D which is used for operating the motor. Throwing the lever fully to one side or the other closes the three-pole switch C of the main circuit. The lever can then be thrown through a considerable distance in the reverse direction toward the centre without opening the switch. During this period the lever acts upon the liquid resistance and varies its height in the tank, thus varying the speed of the motor and placing it at the desired point. When the lever comes to the middle of its course the switch is thrown open, thus breaking the motor circuit. The turbine pump P, which causes the liquid to circulate in the tank, is driven from a small three-phase motor connected to the 2,000-volt circuit through a transformer. The apparatus is so regulated that in the position of the lever which corresponds to the motor starting, the liquid always has a determined height between the plates, so that when the motor is thrown on it receives the required amount of current to start it properly.

All the different apparatus for operating the cable drum are placed under-

neath the floor and are only accessible after the current has been broken. The motor field, switch bases and different parts of the mechanism are connected to earth, so that there is little danger from the high-tension circuits. The braking system has been well carried out in this plant. The cable drum carries a set of massive brake shoes which work upon its outer surface in the front and rear. One of these can be distinguished in the photograph. These are operated as air-brakes, in which case they are thrown into action by a hand lever. An automatic device is also provided for throwing on the air-brakes should the speed of the cable exceed the proper limit, and the same mechanism throws the emergency switch to cut off the current from the motor. In case the current should be accidentally cut off from the circuit, for instance when the main fuses are blown, an electromagnetic device is used to throw the brakes. It is shown at F, and consists of a solenoid which is traversed by the current and under normal conditions it holds up a core in the centre. The core controls a lever provided with a counterweight, which is connected with mechanism of the air-brake. Should the current be cut off, the lever falls and operates the brake. The same transmission rod is connected by a set of rods and levers with the emergency switch B so that the latter is operated, cutting off the current for the motor at the same time that the brakes are applied. In case the air-brakes should fail to work, the same brake shoes are connected with a lever L which is provided with a counterweight. The operator has a pedal R near him by which he can release the weight and so throw on the brakes; the same movement cuts off the current from the motor at B.

Another mining plant of considerable interest, of a different character from the former, has been recently erected at the Arnim coal mines, which are located at Planitz, near Zwickau. This installation (see Fig. 4) consists of a double set of cable drums, each of which is used in a separate shaft. Each of the shafts is 220 metres deep and the cable draws up a load of 600 to 700 tons in ten hours. The present plant was laid out under different conditions from the precedent; in the first place it was direct-current motors to drive the cable drums, and it was also desired to mount the apparatus as near the mouth of the shaft as possible so as to cut down on the length of the cable used to operate the system.

The mine company spared no expense to have the present installation made in as complete a manner as possible, so as to demonstrate the utility of the electric system as applied in such cases and see whether it possessed the advantages which were claimed for it. It may be stated that the new plant has proved all that could be expected, and is much superior to the old method of driving by steam engines. The electrical outfit has been supplied by the same firm which put in the preceding plant. It is operated on 500 volts, direct current, and is a good example of the use of continuous current in such cases. Contrary to alternating current, which allows the use of the simple form of liquid resistance mentioned above, the use of direct current requires more or less complicated switch devices and resistances. This difficulty has been overcome in the present case by making the regulation not upon the main current but upon the exciter circuit of the generator which delivers the current. In this way the motor speed is controlled with the use of a comparatively simple apparatus, as the regulating device now uses but a small percentage of the main current.

A separate generator is used to furnish current for each of the direct-current motors and the latter are thus independent of each other. The generators are driven by horizontal tandem-compound engines, constructed by the Gorlitz Machine Works. The mechanical part of the cable plant was furnished by C. Hoppe, of Berlin. Each of the cable drums elevates 600 kilogrammes load per trip and at the same time it is arranged so as to draw a fully loaded car through the mine. The total load per trip may be thus reckoned at three tons. The speed is 8.5 metres per second for the load and a maximum of three metres per second for the cable.

One of the engravings shows the main working parts of the cable mechanism. The dynamos which furnish the current are located in another part of the plant. Each of the cable drums is operated direct by a ten-pole continuous-current motor. These motors are required to furnish a maximum of 225 horse-power at starting. The motor shaft is connected by a coupling with the end of the shaft carrying the cable drum. The latter has a diameter of 2.24 metres and a width of 0.85 metre. In the present disposition, one of the cable drums is keyed to the shaft, while the second can be thrown on or off the shaft by a special coupling. The second drum carries an independent cable which can be made to work at different levels of the mine when desired. The fixed drum is provided with a rim upon which works a band-brake; the latter is thrown on by the operator. He works a hand lever which releases a counterweight, and the descent of the weight throws on the brake-band by a suitable mechanism. On the second drum is placed an air-brake apparatus which is used only as an emergency brake. It is connected to another lever at the operator's hand, and has also an automatic device which throws it on should the speed rise too high. The band-brake is not only worked by the counterweight and lever, but can be also thrown on gradually by means of a hand-wheel and screw.

The motors are started and have their speed regulated entirely by the operation

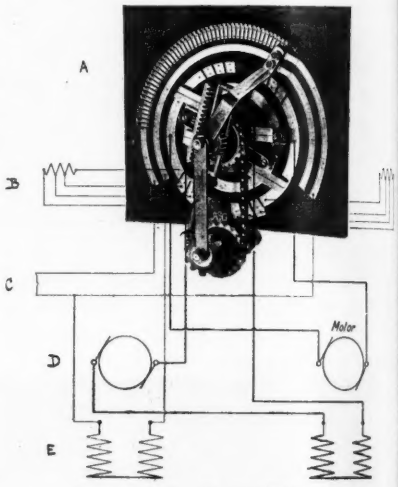


FIG. 5.—SPEED REGULATOR.

of the field circuit of the main generators, without using any resistances in the circuit which passes from the dynamos to the motors, and in this way there is scarcely any loss of energy. Each of the motors is furnished with current from its generator by an independent circuit and the current is always supplied at the required voltage. The main generator is separately excited and its field takes current from a small dynamo which is belted to the steam engine. In the circuit of the exciter is placed the operating device for the system, consisting of a special rheostat, which varies the voltage of the field between zero and 240 volts. At zero, the main dynamo ceases to be excited and the motor, having no current, comes to a stop. The voltage of the exciter is now gradually increased by turning the rheostat, exciting the field of the main dynamo, and thus bringing the motor gradually up to speed. The maximum speed of the motor is reached when the dynamo furnishes 500 volts to the

circuit. In this case the motor operates at seventy-two to eighty revolutions per minute. By reversing the operator's lever, which is connected by a transmission device with the rheostat, the motor is slowed down or brought to a full stop, and thus a very simple and effective control system is obtained. It is to be noted that all the regulation takes place by operating the circuit of a small dynamo, and there is scarcely any trouble from sparking at the contacts. The apparatus shown in Fig. 5, as will be observed, consists of a circular rheostat panel with a set of contact rings for the different circuits. At A is the set of contacts for the rheostat: B B, the cutout resistances for the contact break; C the exciter circuit; D and E the armature and field of the principal dynamo respectively.

Since it was installed, the operation of the electric system with direct-current motors has proved so successful that it is now proposed to change over the whole mine plant from the former method of steam driving.

Protection Against Lightning.

In order to more thoroughly understand the methods of protection against lightning, and because of the frequency of fires caused by lightning, a committee was appointed by the National Fire Protection Association, of which Inspector W. S. Lemmon, of the German-American Insurance Company, of New York, was made chairman, to investigate such fires and submit specifications for their prevention. The committee has presented a preliminary report, and a part of this is an interesting table showing the following results: from 1898 to 1902 there was a total of 357,346 fires investigated. Of these 15,755 were caused by lightning. Of a total loss by fire of $780,000,000, the fires due to lightning caused a loss of $21,767,185. These figures indicate an average number of lightning fires per year of 3,151, as compared with an average number of 71,469 from all causes. The figures show an average total loss per year from lightning fires of $4,353,437, as against an average of $156,000,000 from all causes. Of the buildings affected by fires caused by lightning included in this tabulation, 3,842 were dwellings (an average of 768 per year); 9,375 were barns (an average of 1,785 per year); 328 were churches (an average of sixty-six per year), and thirty-eight were ice houses (an average of eight per year). The committee remarks that no generally accepted theory of thunderstorms has yet been formed, although, in a number of special cases, a realization of the conditions existing at the time has been arrived at. To what extent forests and trees act preventively is no more definitely known that the degree of protection afforded by lightning rods, although it seems to be established that trees surrounding a building, if not too near, are a source of protection; but if too near, prove to be a menace. The lightning rod conference in London, 1882, gave the following order as to the susceptibility of different kinds of trees to lightning: oaks, 100; elms, seventy-seven; pines, thirty-three; firs, ten; fir trees in general, twenty-seven, and beeches, two. It is well established that trees standing in temporarily or permanently moist soil are more likely to be struck than those in sandy or dry soil. It has been proved that lightning conductors, properly installed, are a protection; and notwithstanding that one is providing against an unknown quantity of current, it is believed that there is a limitation which, if provided for by sufficient metallic surface area properly arranged, may absorb and dissipate any charge likely to occur. At the same time, the protection afforded by a conductor will depend upon the relative positions of the electric discharge and the object it meets in its course. The more any object projects above the general level, the nearer to the cloud and the less the resistance offered to the discharge. High objects are therefore more frequently struck; hence the need for more careful protection. A lightning conductor fulfils two functions: it facilitates the discharge of the electricity to the earth, carrying it off harmlessly, and it tends to prevent disruptive discharge by neutralizing the conditions which determine such discharge in the vicinity of the conductor. A number of specifications are included in this report for the protection of buildings against lightning. Protection against lightning is advisable on country buildings, on isolated buildings, and on all buildings, wherever located, having elevated features such as tall chimneys, steeples, high peaked or gabled roofs and flag poles. One rod with proper area and earth terminal is recommended per unit of roof area, as follows: pitched roofs of metal, one each 2,000 square feet of area; pitched roofs other than metal, one each 5,000 square feet of area; flat roofs other than metal, one each 2,500 square feet of area; flat roofs of metal, one each 5,000 square feet of area. Where trees stand so close to a building that branches overhang or approach very close to the roof, a conductor with proper earth terminals should extend along the trunk of each tree to near the highest branch top, fastened by a band around the branch or trunk, and equipped with a cluster of points. If extreme protection is desired, wires should be strung from tree to tree across the roof of the building, and all connected together, the ends being separately grounded. In either case the buildings should also be equipped. But one kind of material should be used in the same system. The conductors should be in sheet or tape form, of either copper weighing not less than six ounces per foot, or of iron weighing not less than two and one-quarter pounds per foot. The upper point should be cone-shaped, and the height of the cone should be equal to the radius of the base. Air terminals should be of copper rod not less than five-eighths of an inch in diameter. Terminals should extend not less than three feet above flat or peaked roofs or chimneys, and should be firmly secured in an upright position. They should be run as straight as possible, avoiding all turns of a radius less than one foot. The conductor should never be insulated, but fastened securely to the surface to be protected by clamps of the same kind of metal. Conductors should never be run through iron pipes. The best ground consists of a copper plate not less than two by two feet by one-sixteenth inch, buried in permanently damp earth below the frost line, and not less than four feet below the surface, with three inches of crushed coke or charcoal underneath, and the same material above to within six inches of the surface of the ground.—*Insurance Engineering.*

The Pacific Coast Electric Transmission Association.

The next annual meeting of the Pacific Coast Electric Transmission Association will be held at Portland, Ore., beginning the third Tuesday in June, 1905. Its sessions will constitute one of the series of association meetings to be held under the auspices of the Lewis and Clarke Centennial Exposition. Mr. H. W. Goode, president and director-general of the exposition, and president of the Portland General Electric Company, is president of the association. Mr. C. H. Pennoyer, general manager of the United Gas and Electric Company, of San Jose, Cal., is vice-president. Mr. George P. Low is secretary and treasurer.

Insurance Company Installs the Telautograph.

It is stated that the Prudential Insurance Company has installed the telautograph at its Newark (N. J.) offices, for the transmission and recording of messages between the cashier's office and the policy loan department.

The Earth Currents.

M. Guarini recently gave a very interesting lecture to the Société Belge et'astronomie; this lecture was on the much-discussed subject of earth currents—that is to say, those currents which go through the earth, but which are generally produced by some outward cause. M. Guarini says that all the theories put forward to explain the earth currents, such as the influence of the wind, aurora borealis, rain, storms, electrochemical effects, etc., none of them accounts for an incontestable fact; for there is in the earth an earth current, whose direction is carefully marked out, going from northwest to southwest. Now a constant effect can not be due to variable causes, at any rate as variable and intermittent as those referred to above; wind, storm, etc. According to M. Guarini, the atmospheric agitations produce some of them by friction (the wind), others by induction (hail, rain, snow, etc.), certain variations of potential at certain places in the ground. These are the fluctuations of the potential, says M. Guarini, which produce at certain moments sudden variations in the intensity, and even in the direction of the earth currents.

According to M. Guarini, the earth current can only be due to a cosmic effect; that is to say, due to the rotation of the earth (the armature) round the sun (the field). By the rotation of the earth, there would be induced into the atmosphere a current going in an inverse direction from that of the rotation, as in dynamos; this variable current induced into the atmosphere induces in its turn in the earth's crust an inverse current; that is to say, moving in the same direction as the rotation of the earth. Now theory and observations agree with the idea put forward by M. Guarini. Siemens and Geitel have proved that the sun induces a vitreous charge into exposed objects. On the other hand, from Palmieri's observations it appears that the earth current is a current induced by the atmosphere. Lastly—and this is the most interesting fact—experience proves, as M. Guarini says, that the earth turns from west to east; that is to say, that the rotatory movement of the earth takes the same direction as that of the continuous earth currents. M. Guarini believes that it is possible, as Ampere always insisted, that it is the earth current which makes the magnetic needle deviate. M. Guarini points out that in that particular also facts and theory coincide, and he proposed an experiment to prove this.

After having spoken of the influences of tramways and transmissions with the earth as a means of return on observatories, he refers to his trials and those of the Compagnie de l'Industrie Electrique et Anécanique de Genève, for the purpose of suppressing them completely. Lastly, the earth currents are very useful in agriculture because they decompose the chemical products which are in the earth, and replace them by others more assimilable for the plants. M. Guarini tells us that the earth currents will one day receive practical application, and he goes on to show how this result may be obtained.

National Electrical Contractors' Association.

For the convenience of those who desire to attend the opening session of the International Electrical Congress, which convenes on the morning of September 12, the convention train of the National Electrical Contractors' Association of the United States will leave the Grand Central station, New York, at 1 o'clock P. M., September 10. Members and others who desire to take advantage of the facilities offered by this convention train should forward the full amount of fare to Alexander Henderson, 527 West Thirty-fourth street, New York city, or to M. C. Roach, general eastern passenger agent, 1216 Broadway, New York city.

Passengers from New York, Philadelphia, Baltimore, Washington and points south will board the convention train at the Grand Central station, New York city, September 10. Passengers from Worcester, Springfield, Pittsfield, Boston and points east will connect with the convention train at Albany, N. Y., at 4.05 P. M. on September 10, by the train leaving Boston at 10.45 A. M. on the same day. These passengers must change cars at Albany.

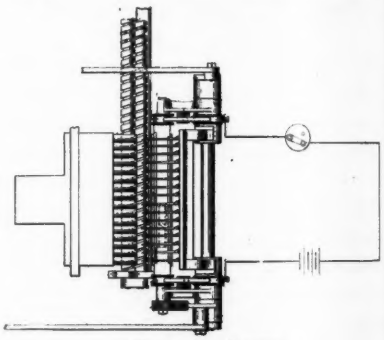
Eastern passengers are informed that the Fall River, Providence and Stonington boats leaving on the evening of September 9 are due to arrive in New York in ample time to connect with the convention train at the Grand Central station on September 10.

A New Fuel.

By the aid of an electrical process a new fuel "osmon" has been produced from peat. A direct current is passed through the mass by which twenty or twenty-five per cent of the water is eliminated. The electrically treated peat is then dried and crushed and made up into briquettes. It possesses quite a satisfactory heating power, contains no sulphur and does not smoke or leave much residue.

Electrical Patents.

A magnetic chuck has been devised and patented by Mr. Charles W. Sponsel, of Hartford, Ct., and a one-half interest in the patent assigned to Mr. Charles F. Taylor, of the same place. The magnetic carrier is mounted in any suitable framework and has trunnions journaled in arms, keyed to a rock-shaft which is operated in any desired way as, for instance, by a pitman, connected with a crank-arm secured to the rock-shaft. Conveyer screws are employed which may be driven either intermittently or continuously to advance articles held between the threads thereof to positions where the carrier may receive them. The magnetic carrier comprises a hollow rectangular form, the sides of which are formed of two non-magnetic plates having notches for the reception of the articles to be inspected. Back of these plates are magnetizable plates of less width than the first mentioned ones, so that their upper edges will be below the bases of the notches and will not come into contact with

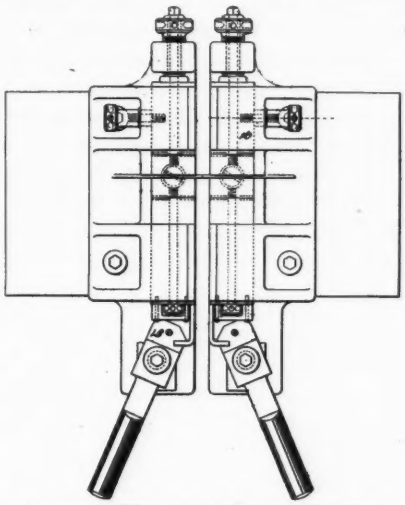


MAGNETIC CHUCK.

the articles to be inspected, but will have their full effect when energized to retain the articles in the notches. The plates are separated to form a coil-receiving chamber by a central core, around which is placed an oblong coil composed of insulated wire of small gauge. To enclose and protect the coil, top and bottom plates of non-magnetic material are placed between the magnetizable plates; all the parts are firmly secured together by screws passing through the two sets of plates and threaded into the core. Trunnions are provided with heads for closing the ends of the coil chamber and these heads are grooved to receive tongues on the plates. Spools, composed of vulcanized fibre or other insulating material, surround and are keyed to the trunnions; the flanges of these spools bear on one side against bearings of the arms and on their other sides against the heads of the trunnions. Between the flanges

of each spool is a metallic contact ring; the ends of the coil, from which the insulating material has been stripped, are inserted within the contact ring. Reduced extensions are journaled in bearings of the arms; to the outer one of these extensions is secured a gear-wheel. A rock-shaft is journaled in bearings rising from the frame or stand and is actuated by a pitman connected to a crank-arm by any suitable means. Means are provided for energizing and deenergizing the electromagnets of the carrier. For axially rocking the carrier a toothed sector is employed in engagement with the gear on one of the extensions. This sector is located at the end of an arm having a hub sleeved upon the shaft between an end collar thereof and the hub of the outer arm, and for actuating this sector-arm a rod is articulated to a projection of the arm at one end and may be operated mechanically or otherwise. Projecting from a frame or stud is a standard in which is formed a cam-groove adapted to receive a pin, secured to the notched plate. This plate is provided with slots through which the screws pass; when the pitman is actuated to rock the carrier, the stud of the plate will enter the cam-groove and will throw the plate to the position necessary to conform to the inclined location of the nails or other articles upon the conveyer screws; and as the carrier is rocked back, the plate will be actuated by the cam to bring the articles received by the magnets from the conveyer screws to the proper position for the action of the chucks employed for intermittently turning the articles to present them for inspection.

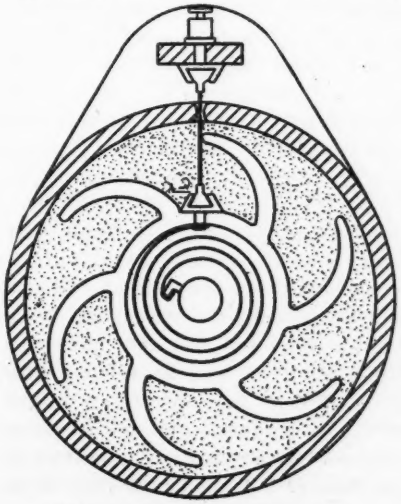
Mr. Adolph F. Rietzel, of Lynn, Mass., is the inventor of an electric welding-clamping device, the patent on which he has assigned to the Thomson Electric Welding Company, a corporation of Maine. In carrying out the invention, the platens form, as usual, the terminals of a source of electric current; one is provided with means whereby with its clamping device it may be forced toward the opposite platen-plate carrying a second clamping device. These clamping devices consist of a pair of jaws for each platen and means for supporting and moving one jaw toward and away from the opposite one for the purpose of clamping and freeing the work. The movable platen, while being in connection with one pole of the source of the heating current, is properly formed or provided with suitable guiding devices to keep the parts in alignment. Extending longitudinally through the clamp slide or block is a fastening pin or bolt which engages the clamping jaw and holds it firmly seated against the block. The rod passes through a sleeve within the screw, the wear-plate has an opening at its centre through which the



ELECTRIC WELDING CLAMPING DEVICE.

rod passes. Suitable means are provided for preventing the clamp-jaw from turning upon the rod when firmly seated against the face of the block. The slide or block is properly seated in a guide formed upon the clamp body, the housing being opened on the face nearest the work and the slide or block being held in place by the plates and guides in suitable ways in the housing. By this construction, it is possible to readily detach and replace the clamp-jaw without disturbing in any manner the adjustment of the screw. Suitable means are also employed for fastening the block in its adjusted position.

Improvements in the means for extinguishing arcs have been devised and



MEANS FOR EXTINGUISHING ARCS.

patented by Mr. Rudolf E. Hellmund, of New York, N. Y., the object of the invention being to prevent the sparking or arcing produced on interrupting electric circuits by means of switches, cut-outs, circuit-breakers, etc. Various means have hitherto been employed for overcoming this objectionable sparking, such as blasts of air or other gas or certain quantities of liquid directed against the place where the arc would form, but all these means necessitate the employment of air and water-tight appliances, not to mention the fact that they are expensive and complicated. In Mr. Hellmund's invention, a casing is provided having an extension from which projects a ledge supporting a binding-post from which a socket, designed to receive one end of a fuse-link, depends. The casing has an opening through which the fuse passes, the other end of the latter is held in a socket secured on the periphery of a wheel, mounted to revolve about an axis and provided with a plurality of blades. On the axis is a finger to which is secured one end of a helical spring, the other end of this spring is secured to a stud contiguous to the socket. The spring serves the double purpose of turning the wheel in one direction and as an electrical conductor between the fuse and the axis, which is secured rigid with the cover-plate of the casing and in contact with the binding-post mounted thereon. The casing is designed to contain sand or similar substance. Hence, in practical operation, when the fuse melts and parts, the wheel, being then free to turn under the influence of its spring, will rotate and its blades will project a quantity of sand across the arc produced by the separation of the parts of the fuse, at the same time quickly carrying one part of the fuse away from the other, which assists in disrupting the arc.

An Electric Railroad for Mont Blanc.

M. Baliot has prepared plans for an electric railroad to be built up Mont Blanc. The cog-wheel system, as used on the Jungfrau road, will be employed. The road will start at an elevation of 3,260 feet and terminate 810 feet below the summit—a distance of 14,970 feet above the sea. In the ascent of 11,710 feet the road will traverse eleven miles.

Convention of the Minnesota Telephone Association.

On August 31 and September 1 the Minnesota Telephone Association will hold a convention in Minneapolis. The meetings will be held at the fair grounds. A number of interesting papers will be presented and the association extends an invitation to all telephone men to be present.

Reviews of Current Engineering and Scientific Literature.

Wind-Driven Electrical Works.

The Danish government has been investigating the problem of utilizing wind power for small electrical works, and has met with some success, writes Dr. Alfred Gradenwitz. With the dynamo coupled direct to the wind motor the results are very unsatisfactory, but this difficulty has been overcome by a simple regulating device. Two belt discs are mounted on a movable arm bearing a counterweight. One of these carries a belt from the wind motor and the other one from the dynamo. The resulting tension of the belt from the wind motor is kept constant, depending on the weight of the discs and the counterweight. Any surplus energy developed by the wind motor is lost as heat with the friction of the belt. The current from the dynamo is used to charge a storage battery. Between the dynamo and the battery is interposed a switch. This is closed automatically when the current intensity is not inferior to its normal constant value. When the wind is sufficient and the battery nearly discharged, the dynamo will run at a speed sufficiently high to charge the battery with the normal current of a dynamo. As the charge increases the dynamo will automatically increase its speed and load so as to make the charging current constant. A cell controller will have to be resorted to in charging only in exceptional cases; for instance, if the charging and discharging in the battery are taking place simultaneously. An electrical regulating device disconnects the dynamo as soon as the current decreases below the normal number of amperes. This arrangement prevents the accumulator battery from discharging through the dynamo when the strength of the wind is small. This regulator will automatically insert the current when the wind again assumes a sufficient strength. A small plant arranged in this way has been operating at Askov and supplying the inhabitants surrounding it. As a reserve in case of low wind, a gasoline engine has been installed. The plant thus far has been very satisfactory and has brought in a net revenue of twelve and one-half per cent on the original investment.—*Abstracted from the Canadian Engineer, August.*

The Use of Series Spark-Gaps for X-Ray Work.

The doubt which existed when radiography was first used as to the most efficient apparatus to generate currents for the X-ray tube does not prevail to-day. It is conceded that the induction coil is the most satisfactory apparatus that we have for energizing the Crookes tube, writes Dr. L. Weiss. The static machine will serve satisfactorily for small work in competent hands, but the exposures are longer than those of the coil. For very large work the coil is not only preferable, but necessary. While fifteen to eighteen-inch coils are guaranteed to give a heavy hot spark and not to break down, it is not so easy to make a tube to stand the output of so large a coil. Few of the tubes made can stand the full output of a fifteen-inch coil with fifteen amperes of current in the primary for longer than one-half to one minute. There is great danger of destroying the vacuum, while the inverse current generated by the coil has a tendency to blacken the tube. The main reason that the tubes break down is because of the inverse current generated by the coil. As this current is not apt to jump over an air space of from one to two inches when placed in series with the terminals of an induction coil, Dr. Weiss uses a spark-gap and finds that it eliminates to a very great extent the harmful qualities of the current. He found by experiment that it took twice to three times the length of time to heat up the anode when the spark-gap was used, and that its use also shortened the length of time necessary for exposure and gave better radiographs. The most convenient way to mount the spark-gaps is on a wooden rod about two feet long with one gap at either end. At each end of the rod is a piece of hard rubber about one-quarter of an inch thick and five inches long, and on this hard rubber are two upright posts three inches in height. The first has a pointed edge to receive the current and a loop for the conducting coil; the second has a hole drilled through its upper part through which slides a metal rod five inches long. At one end of this is a point to transmit the current and at the other a loop for the conducting coil. This sliding rod can be adjusted from the point on the first post up to a distance of two inches and thus any spark-gap obtained. Conducting cords run from the terminals of the coil to the loop on the sliding rod and the top of the first post. The posts must be fully four inches apart, otherwise the rubber tends to carbonize and act as a conductor.—*Abstracted from the Medical Record (New York), August 6.*

Mechanical Draught for Boilers.

Mr. Walter Yates, in a paper read at Liverpool, England, before the Institution of Heating and Ventilating Engineers, considers the problem of mechanical draught for boilers in its various aspects. Natural draught is that produced by a chimney. The only openings to a chimney should be at either end, the top allowing the hot gases to escape, and the bottom, represented by the boiler, allowing the cold atmosphere to flow in. Under these conditions the inflow would continue until the internal walls of the chimney fell to the temperature of the external, when the flow would cease and commence flowing upward or downward, as the temperature rose or fell. Leakage of air through a chimney or boiler setting has a very serious influence on the draught, and is often accountable for greatly decreased efficiency. In the author's opinion, by far the best method of obtaining draught by mechanical means is the induced draught system, wherein the fan is placed between the boilers and chimney or point of discharge of waste products into the atmosphere. Where an economizer is made use of an opening is made in the flue between the economizers and the chimney, and the fan inlet connected thereto by a short brick or metal flue. Another opening is made in the main flue at a point nearer the chimney, or into the chimney itself, and this opening is connected to the fan outlet in the same way as to the inlet. One of the best arguments in favor of induced draught is that by it the pressure may be kept practically constant, and consequently the temperature, so that the boiler shell and furnaces do not contract and expand to the same extent, saving large sums of money in repair bills for leaky joints and rivets. One of the most valuable features of an induced draught apparatus is that it enables the high temperature upon which a chimney depends for its results to be dispensed with. It is not fully recognized, says the author, that the calorific value of coal is not at all in proportion to its cost. The lower grades of coal have a calorific value not a great deal less than the higher priced qualities. The difficulty with chimney draught is to burn them and thus extract

their value. With the fan draught this difficulty is overcome. An important point is the question of the chimney in relation to induced draught. A stack higher than that necessary to carry the gases above the surrounding property—say about fifty feet high—is useless when the induced fan draught is at work. It therefore pays to consider the question of fan *versus* chimney in the matter of first cost, and also as to economy of space. —*Abstracted from the Electrical Engineer (London), July* 29.

The Raworth Regenerative Control for Tramway Motors.

The Raworth controller consists essentially of shunt-wound motors on the cars instead of motors of the series type. Recent trials have demonstrated the advantage of this method. On a trial trip over a somewhat hilly area, it was found that on the return journey 28.3 per cent of the energy drawn from the line was returned by the motors. Mr. Raworth's figures are as follows: the Demi car took on the average 0.380 per unit per car-mile. The car weighs 5.6 tons and carries twenty passengers. It is equipped with two Brush motors, rated at twenty-eight horse-power each. As compared with this, the cars in regular use weigh 9.11 tons and carry forty-eight passengers. They are equipped with two Walker motors, rated at twenty-five horse-power, and consuming 0.97 unit per car-mile. Making these figures comparable, the Raworth car will take an energy of 0.62. This latter figure is sixty-four per cent of the energy consumed by the larger car, thus showing a saving of thirty-six per cent for the regenerative control. Under the Raworth system, the shunt-wound motors are always in use, either receiving current from the line or returning current to it, and consequently have to be larger than those on the series parallel system. This increase in size affects, of course, only the first cost of the car. The cost of maintenance of shunt motors is probably greater. The chief points of the Raworth system may be summed up as follows: the Demi car with regenerative control uses less than half the energy per car-mile than the ordinary cars with series parallel control does. The car is probably more easily controlled and can run up to the facing points at full speed until the buffer is over the points. The brakes are never used except on an incline to hold the car after retardation. There are three definite braking effects: regenerative, the ordinary braking stop and the emergency stop. Sand is seldom required, the adhesion not being overtaxed. The maximum call on the power station is reduced to forty per cent, and the maximum speed of the car can be fixed at the depot. The driver can not possibly exceed this speed even on the descending grade. The controller is extremely simple and sparkless if properly worked. There is no advantage gained by shutting off power at section insulators. Every power position of the controller handle is also a braking position of the down grade or on a level, by retiring the lever one notch. The act of shutting off the power applies the brake and the braking effect is continuous throughout the movement. The motors are in series and remain so. The power circuit is never shut off until it is necessary to stop. The feeder losses are reduced by one-half and the size of the power station about one-third.—*Abstracted from Electrical Engineer (London), July* 29.

Electrical Engineering in South Africa.

In these new fields gas is scarcely a rival of electricity, the cost of distribution being so much greater, therefore the latter has practically a monopoly of the field in South African towns, writes Mr. John Roberts. The power is generated by steam. In most towns the water supply is a serious problem, the lowest cost being two shillings a thousand gallons. Economy of water is then an important point. The quality of the water is good, so that water-tube boilers are the best. In the gold fields and a few places where the water is not so good, it is probably best to use water filters and purifiers rather than other types of boilers, because of the difficulty of transportation of the skilled labor necessary in connection with other types. The English practice of direct coupling has been followed in almost all cases. If oil could be obtained at lower prices, the oil engine would do very well. The installation of turbines is being considered, but the water difficulty will probably militate against their success. Large condensers with cooler towers are most reliable where water for boiler feed is good, but no condensing supply is available. Surface condensers are used chiefly on the gold fields on account of the bad quality of the water. One station, a combined electric lighting and sewage pumping works, has used sewage for condensing and effected a very great saving. Loads are usually scattered and a continuous-current supply is hardly advisable. In small stations a three-wire, 440 or 480-volt network should be used, generally these plants are not more than 200 kilowatts in three generating units. Balancers should not be put in, it is simpler to split each generator into two of 220 or 240 volts. A slightly increased cost of dynamos is more than offset by the saving of balancers and switchboard complications. Mr. Roberts does not approve of batteries or day loads. In larger plants continuous current is unsuitable unless a mixed system is adopted and it is very hard to predetermine what is going to be the growth of a city under such conditions. A two or three-phase alternating current is without any rival. In smaller towns overhead mains should always be used with an occasional underground feeder. In larger towns all high-tension mains should be laid underground. The overhead construction is usually inexpensive. Iron poles are generally best as they are not attacked by insects. None of the overhead line material is subject to the smallest depreciation if they are used. As the customers are numerous and small users of power it is hardly advisable to use meters. It would be best to establish a flat rate except for very large users who should be supplied with meters. For the small users an instrument is used so that if more lamps are used than the maximum load contracted for, the lights are immediately dimmed and must be turned off until reduced to the proper number.—*Abstracted from the Electrician (London), July* 29.

Wireless Telegraphy in England.

Mr. W. Duddell has been carrying out some experiments for the British post-office department with his new thermo-galvanometer in connection with wireless telegraphy. His instrument is capable of measuring directly the current received by the aerial and offers a means for making scientific experiments on many of the problems of wireless telegraphy as yet unsolved.

Electric Lighting in Bombay.

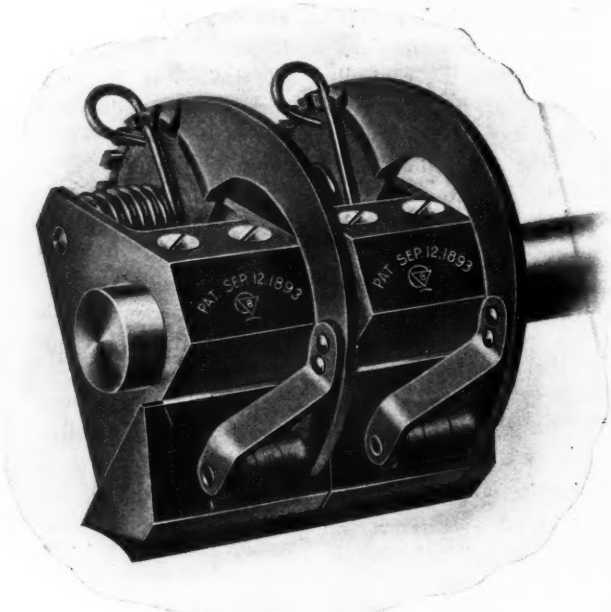
It is expected that by October the city of Bombay, India, and its surroundings will be lighted by electricity. A current of 6,000 volts will be generated at a central station and distributed to substations, where it will be transformed by rotary converters, as the demand for the current will be in widely separated localities.

INDUSTRIAL SECTION.

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS.

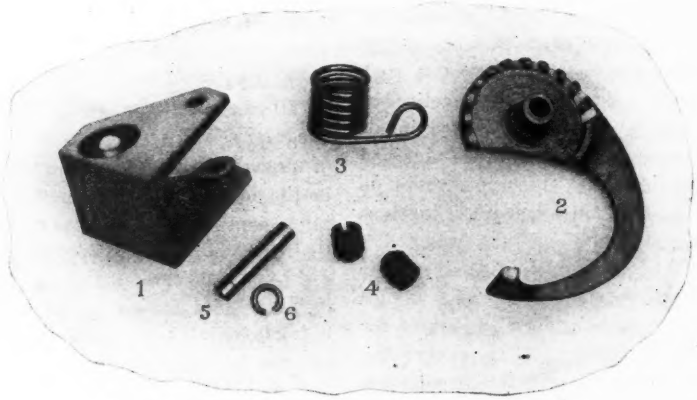
The Reaction Brush-Holder.

The accompanying illustrations show the construction and adaptability of the reaction brush-holder for motors and generators manufactured by the Baylis Company, 140 Washington street, New York city.



THE REACTION BRUSH-HOLDER ASSEMBLED.

Castings for the body portion and the pressure arm are made from a special composition containing about ninety per cent of copper, and selected for its high conductivity. The surface contact against which the brush is held by the mutual action of the pressure arm and commutator is subjected to a milling operation by special machinery, which produces a perfectly flat surface. The set screws have special truncated cone points, whereby they are equally well adapted for a round stud or for one having a flat or a V-groove. The spring is of the simplest form, with no adjusting screws or locknuts, the pressure on the brush being regulated by changing over from one notch to another to obtain any tension desired. The end of the pressure arm is finely serrated. This feature checks any tendency to side movement, although it is found in practice that such tendency rarely manifests itself.



THE PARTS OF THE REACTION BRUSH-HOLDER.

In its method of operation the reaction brush-holder is unique. The brush, which is preferably beveled at each end, is placed against an inclined contact plate and kept in positive contact by the combined action of the pressure arm at one end and the reaction of the commutator at the other. The brush is thus maintained in intimate contact with the body of the holder, but, at the same time, the brush is entirely free for a movement toward or away from the commutator.

The pressure arm performs the double function of constantly pressing the brush along the smooth contact plate against the commutator, and, in conjunction with the commutator reaction, keeping it always in efficient contact with the body of the holder. The peculiar design of the reaction brush-holder allows of its being placed very close to the commutator. This makes the path for the current between the holder and commutator as short and direct as possible. The result is an exceptionally low resistance path for the current.

The means provided for the adjustment of pressure is simple and effective. There are no screws or nuts to become loose. When the spring shank is placed in the desired notch, it remains there until intentionally removed to another.

The use of a flat contact plate, without retaining sides, makes it possible to use brushes of varying widths. This is an important feature, as it permits the full range of generator and motor sizes to be served by three or four standard sizes of holders.

Production of Copper for 1903.

During the year 1903 there were 565,820 long tons of copper produced, an increase of nearly 25,000 tons over the preceding year. The great bulk was obtained in North America, 60.7 per cent being produced here; the United States contributing fifty-three per cent, Europe yielded 16.5 per cent, Spain and Portugal being the leaders. Japan and Australia contributing 10.7 per cent and Chili 7.1 per cent.

Cost of Street Lighting in Chicago.

It has been found that if the city of Chicago could obtain at cost the power to be manufactured by the three million dollar plant being built at Lockport by the sanitary board, that the expense to the city for each horse-power would be $10.25; the present expense is $29. An attempt will be made by the city officials to secure from the sanitary trustees the use of this power for the better lighting of the city and municipal buildings.

Electric Laundry and Tailors' Irons.

The Simplex Electric Heating Company, Cambridgeport, Mass., is placing on the market two new specialties which are the inventions of Mr. James I. Ayer, manager of the company. These improvements in electrical heating apparatus are electric laundry and tailors' irons, with a stand to receive the iron and a rheostat that is automatically put in series with the iron when it is placed on the stand, and short-circuited when the iron is removed. When it is realized that the iron must be supplied with current sufficient not only to provide for radiation, but for the demands of the work while in the operator's hand, it is clear that when the iron is idle the current is in excess of what is necessary to keep it at a working temperature. The effect of this excess current is to rapidly raise the temperature beyond what is desired; and if the iron is idle long enough the high temperature is injurious to the heater.

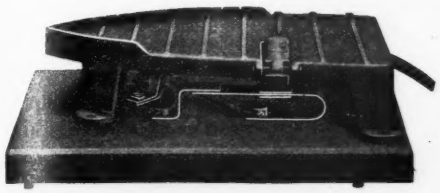


FIG. 1.—SHORT-CIRCUITING STAND, WITHOUT IRON.

The automatic regulator, operating to reduce the current from fifty to sixty per cent on the iron, and from thirty to forty per cent of the total supply from the line, not only prevents the overheating of the iron, but effects a material saving in the cost of operation. In factory work, where irons are in regular use, they are shown by tests to be idle from twenty-five to forty per cent of the time they are kept in circuit.

FIG. 2.—SHORT-CIRCUITING STAND, WITH IRON IN PLACE.

Fig. 1 shows the stand without an iron, and Fig. 2 one with the iron in place. The short-circuiting switch is shown mounted on a slate base under the rheostat, which is the support for the iron. An iron lever projects above the surface of the stand when the iron is in use, and the switch stands in the closed or short-circuited position. When the iron is placed on the stand the lever is depressed by the weight of the iron, and the switch is opened. The stand is wired in series with the iron, and the switch so connected that when the iron is off the stand and the switch is in the closed position it short-circuits the rheostat stand and allows the current to flow directly to the iron; and when opened by placing the iron on the stand, the current flows through the rheostat stand to the iron, and effects the reduction of the current.

For machine irons and other electrical tools not requiring stands, a handle switch is provided to effect the same result when the handle is released by the operator. For electric soldering irons a bench stand for the reception of the iron is provided to produce the same result. For bench work, where there is an irregular demand for a soldering iron, much time is saved, for the iron is kept ready for instant use with less than half the normal current supplied while idle, and the iron is in no danger of overheating or burning out.

The Telpherage Equipment of the New Orleans Lighting Company.

The New Orleans Lighting Company, New Orleans, La., one of the largest gas lighting companies in the South, is devoting a large expenditure to the equipping of its installation with the latest and most improved forms of labor saving apparatus. Mr. Thomas D. Miller, under whose management the company has been remarkably successful, has recently installed a telpherage equipment

FIG. 1.—TELPHER LOADING FROM CARS.

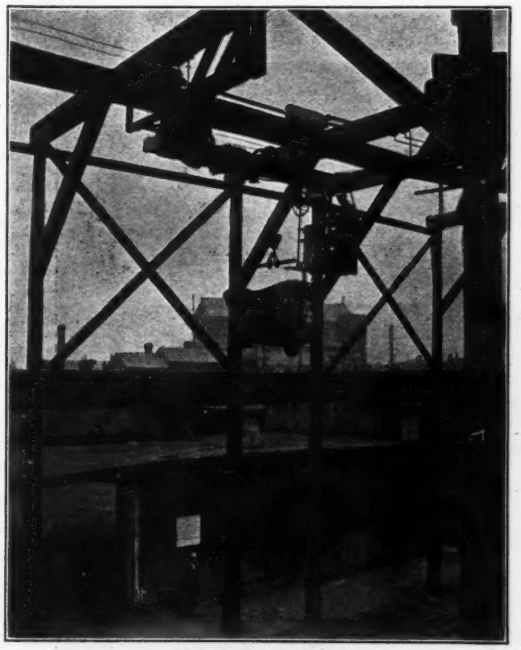


FIG. 2.—DETAILS OF TELPHER.

for it, the services of which have given entire satisfaction. The material for this telpherage plant was shipped from New York under the direction of the United Telpherage Company, 20 to 22 Broad street, New York city, with complete working directions. The installation is for the purpose of taking coal from closed or box-cars, carrying the coal into the generator house, or depositing it in coal-sheds. It may also be used for the purpose of taking coal from the sheds to the generator-house.

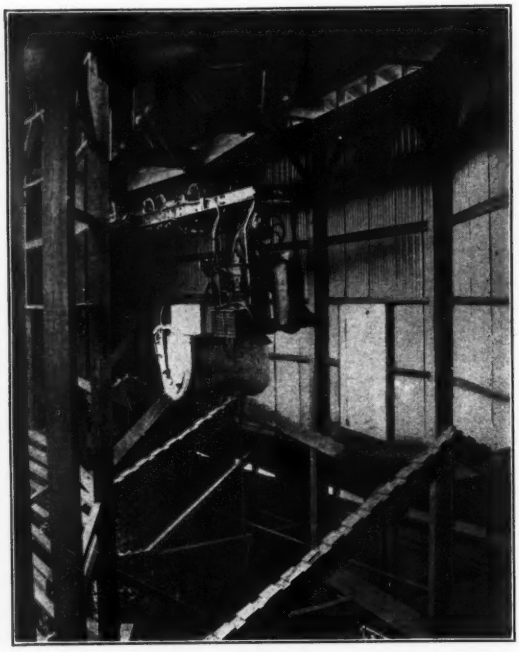


FIG. 3.—TELPHER IN STORAGE BINS.

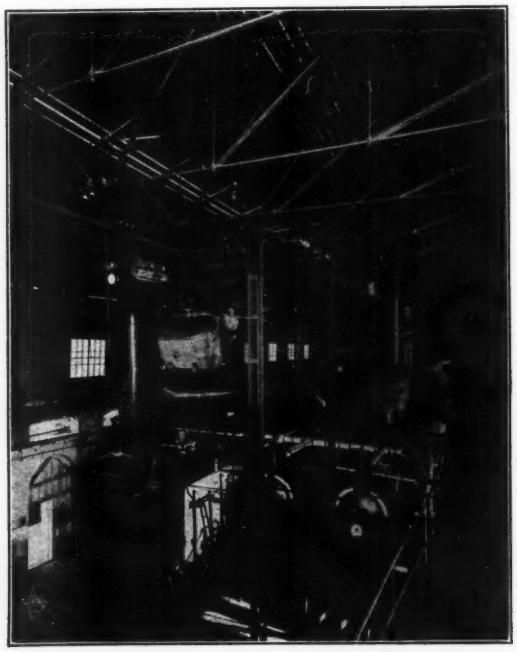


FIG. 4.—TELPHER SERVICE IN STEAM PLANT.

This plant has been in operation for some time, and a few weeks ago, upon Mr. Miller's invitation, a number of civil engineers of New Orleans and vicinity visited the gas plant and found a great deal of interest in the inspection of the telpherage equipment.

The accompanying illustrations will give a good idea as to the equipment and the method of operation. Fig. 1 shows the track where the telpher leaves the generator-house and passes along the line of coal cars and back to the generator-house. The telpher, with telpherman, cab and bucket, is seen in the centre of the track, with the bucket lowered by the side of the cars. One method of handling the coal is to have it shoveled into the buckets and lifted and transferred in the usual way. Some systems use clam-shell buckets, either to take the coal from the cars or from pits alongside the cars. The former method is used in the New Orleans plant.

Fig. 2 shows the details of the telpher, trailer and hoist. This is a nearer view of the conveying machinery than Fig. 1.

Fig. 3 is a view of the inside of the coal-sheds, showing the bucket just after it has deposited its load of coal. The monitor was built above the old coal-sheds, the old rafters or cross-timbers below the monitor roof being removed. By this means the coal-sheds can be filled to the peak of the rafters, thereby utilizing all the space in the sheds for storage.

In Fig. 4 is shown the conveying machinery passing over the boilers and generators. This is an interesting view, as it shows the method of supporting the telpher line in buildings. Where the roof timbers or trusses are of sufficient strength, the telpher track is attached directly to the cross-girders, but in this case independent supports are erected in the generator-house, and the supports, cross-beams and track are entirely of steel construction.

The working drawings and plans were all passed upon and approved by Mr. F. H. Sheldon, a well-known gas engineer of Philadelphia.

A New System for the Care of Standard Instruments.

The Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., has established a department of standards in order to secure the service it requires in the production of its instruments, and the contrast between the closely maintained accuracy of the checking instruments calibrated by its department of standards and the general lack of uniformity prevailing among the checking instruments in central stations is being constantly made apparent. The company has produced a line of instruments of precision, and it has a sincere and active interest in the continual accuracy of this apparatus. It has therefore placed the facilities of its department of standards at the service of owners of these instruments, and will encourage periodical checking and, at the same time, eliminate all questions of delay and expense.

As ordinarily sold, all direct connection between the manufacturer and the instruments ceases when the latter are shipped to their purchasers. With the Westinghouse plan an active interest is maintained in the instruments for the entire period covered by the period of free calibration (five years), and at intervals of greater or less frequency during this time the manufacturer reassumes a responsibility for their accuracy by checking the performance and certifying as to their accuracy.

To encourage periodical checking, the Westinghouse Electric and Manufacturing Company guarantees that there shall be no delay in the examination of instruments by its department of standards, and that they shall be promptly checked and restored to their owners. Unless repairs are necessary there will thus be only a few days in which the owner will be deprived of the use of his instruments, and it will ordinarily be possible for him to send them away and get them back without inconvenience because of their absence.

In addition to the benefits derived from having instruments checked continually by the same standardizing department, there is a general advantage in having the same service as nearly universal as possible, particularly if that service gives a high degree of security in the trueness of electrical measurements. Then, it must be realized, that if perfect instruments could be furnished to all users and their accuracy maintained continuously by reference to a single set of standards of undoubted reliability, an ideal condition would prevail. It is this condition which the Westinghouse Electric and Manufacturing Company is endeavoring to produce, so far as perfection may be obtained under commercial conditions.

New Punched Clip Knife Switches.

The General Incandescent Arc Light Company, New York, has designed a new line of punched clip knife switches to meet the demand for a cheap, reliable switch. They are furnished in 15, 25, 50, 75, 100 and 150 amperes, one, two and three-pole, with or without fuses, single and double throw, spaced for 250-volt service. The switches are made of pure rolled copper, dipped and lacquered and mounted on slate bases, and are designed to meet the underwriters' requirements.

NEW PUNCHED CLIP KNIFE SWITCHES.

A Simple Electric Burglar and Fire-Alarm.

Mr. H. E. Vineing, electrical engineer of the fire-alarm department of New York, has invented a simple fire, water and burglar-alarm. The apparatus consists merely of four screws, two strips of brass, a screw eye and a piece of cotton cord, with wires and a battery. In operation, the cotton is tied to the screw eye drawn across the opening to be protected and attached to a spring hook, so that the cotton holds the spring away from the back screw and the front strip of brass. When the battery is thrown into the circuit, should a burglar enter, the pressure on the cord draws the spring against the front contact, completing the circuit and raising an alarm. Should the cord become wet through the presence of water, it shrinks and completes the circuit. In case of fire, the cord is burned and the spring strikes back to its original position, making a contact from the rear, which also gives the alarm.

Bulletin of the University of Wisconsin No. 79 has been received. It contains an article by Harold Seaman, B. S., on the effect of frequency on steadiness of light emitted from an incandescent lamp. An index to volume ii of the engineering series has also been issued.

A Good Contract for the Moskowitz System of Train Lighting.

The United States Light and Heating Company, 74 Broadway, New York city, announces that the New York Central & Hudson River Railroad Company has adopted the Moskowitz system of train lighting, and has equipped all the cars of the Empire State Express with this system. The New York Central has awarded a large contract to the proprietors of the Moskowitz system—the United States Light and Heating Company—and the work of installing the apparatus will go forward promptly. This contract was awarded after a thorough trial extending over a period of eighteen months.

The Delaware, Lackawanna & Western Railroad Company, since last November, has equipped its dining-cars with the Moskowitz system, and the official report states that it is very much pleased with the working of the apparatus. The company has recently placed an additional order to equip all its dining-cars, and four are now being equipped at the Barney & Smith Car Company's works.

The Moskowitz system of electric train lighting embodies a generator suspended over the truck of the car, and driven by means of a belt from the car axle. A simple and effective pole-changing apparatus is placed at the ends of the armature shaft, which maintains the same direction of current, no matter which way the car is running. An important feature of this system is the regulator employed. This is a new invention of Mr. Morris Moskowitz, and is claimed to hold the voltage uniform either when the train is standing still or running up to its highest speed.

The regulator consists of a magnet controlled by the main current, a special resistance connected to the generator magnets, a reaction spring and a lever uniting them together, with adjusting screws which allow the current supply to be fixed for any given requirement. After the car has attained a speed of fifteen or twenty miles an hour, the voltage and current of the generator are maintained constant, so that perfect uniformity of illumination results. The regulator, together with the automatic switch in the generator circuit, is mounted on a slate panel and enclosed in a case. The dimensions of this case are about fifteen inches wide, twenty-four inches high and six inches deep.

The system is remarkably free from complication, and consists of few parts. Twenty-two thirty-volt incandescent lamps of sixteen-candle-power each have been chosen to properly illuminate a modern day coach. The current required for these lamps amounts to about thirty amperes, and as the generator has a capacity of forty-five, there is always a surplus current to be stored in the battery. The storage battery carries the lighting load when the train is standing or working up to speed.

Telegraph Service in Porto Rico.

The Porto Rico telegraph service has improved wonderfully since the United States government has withdrawn its military force. The insular government maintains the service, educating its own operators and transacting the telegraph business in both English and Spanish; operators being required to use both languages and the typewriter. When it is considered that during the régime of the Spanish government the tape and register were used and it sometimes took days to transmit messages, the improved conditions will be realized. There are forty-two offices in paying operation on the island. The uniform rate is twenty-five cents for ten words. In the school maintained at San Juan for instructions, telegraphy is taught as well as the keeping of office accounts and rendering of reports. The lines are worked by 1,500 gravity cells, renewed every three months. About 100 miles of copper is in use, mostly No. 9 G. I. Poles are of native hard wood, some of them in use for over thirty years. Operators are paid from forty to one hundred dollars per month, women being received on the same basis as men. For the last fiscal year the number of messages sent was 286,386 and the receipts $49,114.07, on which the profit was $13,914.46. Storage batteries with rotary transformers will soon be installed on the main circuits. The Morse code is used. The wires are all single, although it is expected that the duplex system will be used soon.

New Forms of Sturtevant Economizers.

The B. F. Sturtevant Company, Boston, Mass., is manufacturing two types of economizers almost similar in design, but differing considerably in size and capacity. Fig. 1 shows the "Standard" economizer, which is intended for use in conjunction with boilers of various capacities, but which is most practical for boilers with capacities of 350 horse-power and over.

FIG. 1.—STURTEVANT "STANDARD" ECONOMIZER.

Fig. 2 shows the "Pony" economizer, which is built on a smaller scale, and is designed especially for plants of from 50 to 500 horse-power capacity. It differs, however, from the "Standard" in some minor constructional details.

These economizers are flue feed-water heaters, and to agitate the gases and allow them to come into contact with the maximum air—the economizer pipes utilizing in this manner a maximum amount of the waste heat from the boiler—a patent system of staggered pipes is employed. The several sections are arranged so that the pipes of any one section are longitudinally opposite the spaces between the pipes of the adjoining sections.

In order to avoid the deteriorating effect of joints, as few joints as possible are used. Each section is fitted into its wall-box or branch pipe with tapered iron-to-iron joints, no packing being used.

Branch pipes are eliminated at the top of the economizer, and all the pipes used are of gray iron, and cast on end.

Both ends are tapered, and the pipes are forced into the heaters by hydraulic pressure. The caps have taper ground iron-to-iron joints, and can be easily removed. Those directly over the pipes in the top headers are tapered, while all of the others are held in place by through bolts. The bolts do not come into contact with the water, and therefore are not subject to deteriorating effects.

Cast-iron headers are used, the bearing parts being machined and finished to gauge, in order that the taper joints may be absolutely tight. A wall-box is employed as a substitute for the manifold header and branch pipes. This wall-box is placed in the front side wall of the economizer.

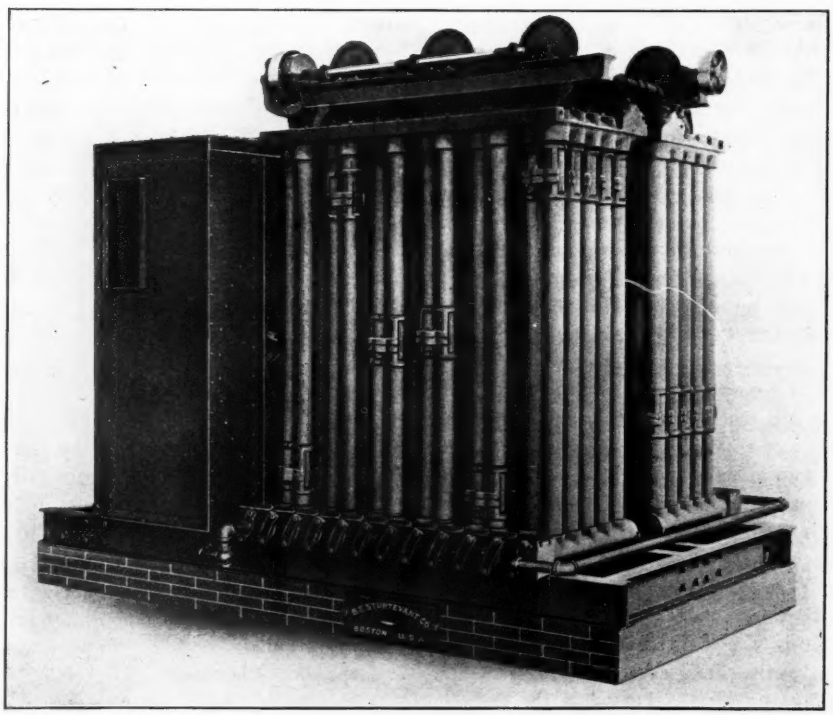


FIG. 2.—THE STURTEVANT "PONY" ECONOMIZER.

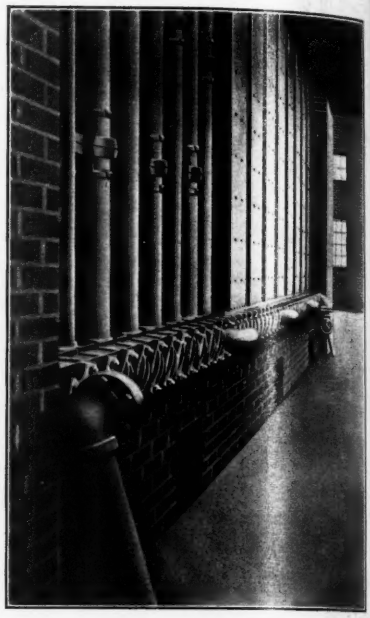


FIG. 3.—STURTEVANT "STANDARD" ECONOMIZER IN CONNECTION WITH 1,000-HORSE-POWER STIRLING BOILERS.

Relief valves, blow-off valves and cast-iron, soot-pit doors are fitted to the economizers. The foundations are usually of brick, and sometimes of structural steel. With a brick foundation a chamber is formed under the economizer, in which the soot accumulates. The inlet and outlet flues are of brick or sheet iron, and when of iron are built of double sheets about an inch apart, filled with a non-conducting material. Fig. 3 shows the "Standard" economizer connected up.

Electric Motor Vans in Paris.

The post office department of Paris, France, will soon employ a number of electric motor vans for the conveyance of mails between the post office and railroad stations. The vans are designed to carry 1,200 pounds at about twelve miles an hour and will be equipped with forty-four accumulators and able to cover twenty-five miles on one charge.

It is announced that the Burlington route of the Pennsylvania Railroad will make an extensive test of practical transportation by electric locomotives. The Westinghouse Electric and Manufacturing Company is said to be building three engines for heavy hauling, of the 130-ton type. Experiments will be begun on the heavy grades in Nebraska, Wyoming and Montana.

CURRENT ELECTRICAL NEWS

DOMESTIC AND EXPORT.

ANOTHER CALIFORNIA ELECTRICAL ENTERPRISE—It is reported that an electrical enterprise has been organized under the name of the Sierra Nevada Water and Power Company, to bring electric power to the cities adjacent to San Francisco Bay. The capital is said to be contributed by English and American promoters, who are planning to utilize the waters of the Mokelumne river and other streams in Calaveras and Tuolumne counties.

EXTENSION FRANCHISE IN CHICAGO DENIED—Judge Grosscup, on August 9, decided against the Union Traction Company, Chicago, Ill., on its claim that the extension of the city limits extended the lines claimed under the ninety-nine-year act. The attorneys of the company insisted that where a franchise had been given in a street "to the present or future city limits," the extension of the city's territory carried the franchise to the new city limits.

LONG-DISTANCE TROLLEY LINE PROJECT—An interurban electric railroad from Payson, eighteen miles south of Provo City, Utah, to Logan, 100 miles north, is being planned. The road will pass from Salt Lake to Ogden, and through the most thickly populated section of the state. Mr. B. Mahler, of Cleveland, Ohio, is said to be the interested party. It is estimated that when the road is completed it will cost about $8,000,000. Franchises will be asked for from the towns and cities through which the road will pass. The city council of Provo has already granted a franchise.

SWEDISH GOVERNMENT ESTABLISHES SUBSIDIES FOR ELECTRIC RAILWAY TESTS—The Swedish government has appointed the Royal Railway Board to make experiments with electric motive power on the state railways. It is said that $115,000 has been voted for this purpose. The Tomteboda-Vartan and Stockholm-Jarfa lines, in the vicinity of the Swedish capital, which belong to the state and have a total length of some eight miles, will serve for the purpose of making the experiments. It is probable that single-phase alternating-current motors will be employed in the experiments.

PORTO RICO RAILWAY, LIGHT AND POWER COMPANY—The Porto Rico Railway, Light and Power Company, a corporation organized under the laws of the state of New Jersey, filed a copy of its charter at the office of the secretary of Porto Rico on July 30, and qualified to do business in Porto Rico. This company will own and operate an electric railroad between San Juan and Ponce. The contract for construction and equipment has been awarded to the West Indies Construction Company. This latter company is also a New Jersey corporation which has qualified to do business in Porto Rico.

MEXICAN ELECTRICAL NOTES—An electric railway between the Rosa Amarilla mining property, located in the Antlan district, state of Jalisco, Mexico, to Navidad, a Pacific coast port, is projected. It is estimated that the system will entail an expenditure of some three-quarters of a million dollars. The necessary current will be secured from hydroelectric plants to be established along the Cusalapa and Santa Maria rivers. M. D. Watson, of Chicago, Ill., is largely interested in the Rosa Amarilla mines, and will probably have control of the contracts for the construction and equipment of the line. It is reported that surveys are already under way.

NEW PHASE OF THE VIRGINIA RAILWAYS RECEIVERSHIP—In the Court of Appeals of Virginia, on August 9, Judge Cardwell granted an appeal forwarded by the Gould interests and the Virginia Passenger and Power Company from the action of Judge Mullen in Petersburg, in appointing a receiver on the application of Mr. George E. Fisher, of New York. As the case now stands, it appears that there will be no question of jurisdiction between the United States and state courts until after the appeal from Judge Mullen's appointment of Mr. Cameron as receiver has been heard. In this case it is unlikely that the appeal will be decided before the spring of next year.

OPENING OF THE EAST BOSTON TUNNEL—It is the intention of the Boston (Mass.) transit commissioners to open the East Boston tunnel for public travel about the middle of October. The Boston Elevated has practically completed its work of electrically equipping the tunnel for the running of its cars. The cost of the tunnel when completed will be in the vicinity of $3,500,000. The rental charge to the Boston Elevated is three-eighths per cent of the gross earnings of the company. Work on the building of the East Boston tunnel was begun in May, 1900. This tunnel is notable for its size, both its exterior and interior diameters being considerably greater than ordinary tunnel construction.

GRAND RAPIDS TELEPHONE COMPANY'S GOOD SHOWING—At the annual meeting of the Citizens' Telephone Company, of Grand Rapids, Mich., the following officers and directors were re-elected: Charles E. Rood, president; Edward Fitzgerald, vice-president; E. B. Fisher, secretary; William J. Stuart, treasurer; directors, Philip Graham, R. D. Graham, C. E. Perkins, L. J. Rindge, E. G. Studley, J. B. Ware and G. W. Perkins. The annual report showed the year to have been a most prosperous one. The net gain of telephones in the system during the year has been 2,357, or almost seventeen per cent. The telephone exchange at Sparta was annexed during the year, and the system now controls 1,116 miles of poles for its toll system, and 1,471 miles of copper full metallic circuits, with 982 miles of iron metallic circuits, making a total of 2,453 miles of toll circuits, with 4,906 miles of wire. The new automatic system which was installed during the past year is said to have resulted in an increased patronage, and the amount of capital stock now outstanding is $1,906,280. The number of city telephones in service is 5,605. The total Grand Rapids connections were 328,168, an increase over last year of 39,596. The company has purchased the telephone system at Allegan, which includes that city, Hopkins Station and Otsego, giving eighty-three miles of new toll lines.

VICTORY FOR TUNNEL COMPANY—The Hoboken & Manhattan Tunnel Company, which is building the tunnel under the North river from Fifteenth street, Jersey City, to Christopher street, Manhattan, has won the first point in its fight against the Delaware, Lackawanna & Western Railroad Company in the condemnation proceedings for a right of way under the Lackawanna's terminal property in Hoboken. After a hearing lasting two months the commission appointed by Judge Dixon, of the Supreme Court of New Jersey, handed in a verdict on August 10 to the effect that such a right of way would damage the Lackawanna's property to the extent of $10,300. In its protest against the granting of the right of way the railroad company said the building of the tunnel would damage its terminal property to the extent of $5,700,000, and claimed that amount if the right of way should be granted. The commissioners who have cut that estimate down by more than $5,500,000 are ex-Governor George T. Werts, of New Jersey; John C. Payne, engineer of the state riparian board, and Colonel John J. Toffey. The lawyers who have fought the case for the Delaware, Lackawanna & Western are John W. Griggs, ex-attorney-general, and William C. Edwards. The lawyers for the tunnel company are Charles L. Corbin, Richard V. Lindabury and F. B. Jennings. President William C. Truesdale, of the Lackawanna, and President William G. McAdoo were witnesses for the opposing companies. Mr. Truesdale's objection to the tunnel was that it would interfere with the future development of his company's terminal. He said that the company might want to build a tunnel of its own some day, or that it might want to dredge out a lot of new slips for the accommodation of transatlantic ships and that the tunnel would be in the way. The line of the proposed tunnel is to be 1,600 feet back from the present line of pier heads. It will connect the Jersey City shaft of the tunnel under the river with the railroad and trolley terminals in Hoboken. A similar spur is to be built in the other direction to connect with the Erie terminal in Jersey City. An order restraining the Hoboken & Manhattan Tunnel Company from going under the Lackawanna terminal is still in effect, and argument on that will be heard at the September term of the Supreme Court of New Jersey.

TELEPHONE AND TELEGRAPH.

ASBURY PARK, N. J.—The Monmouth Telephone Company has applied for a franchise to construct a telephone system in Asbury Park.

ST. JOSEPH, MO.—Articles of incorporation have been filed for the Funston Long-Distance Telephone Company, capitalized at $15,000. The directors are Edmond B. Funston, Jesse G. Funston, J. J. Funston and Thomas J. Porter. The company's main office will be at St. Joseph.

MARTIN, TENN.—At a meeting of the stockholders of the Weakley County Telephone Company G. E. Bowden was re-elected president; T. H. Farmer, vice-president, and R. W. Martin, secretary. T. H. Farmer, John M. Gardner, F. J. Burchard, R. W. Martin and D. W. Scotis were elected directors.

DENISON, TEX.—At a meeting of the stockholders of the Crawford County Telephone Company the following officers were elected: president, W. J. Scriver; vice-president, C. F. Juehnle; secretary, J. F. Glenn; treasurer, Sears McHenry. The company has expended $60,000 in the construction of lines throughout the county, and its profits were such that a dividend of ten per cent was declared on both the preferred and common stock. It was also decided to issue $10,000 additional stock and to further extend the lines.

LEGAL NOTES.

DAMAGES FOR TRESPASS—In the Southwestern Telegraph and Telephone Company *vs.* Whiteman, plaintiff was given judgment for $135. He alleged trespass, a pole having been erected in his yard, and asked $1,000 damages. Before the trial his declaration was amended, as the pole had been removed from the premises.

WITH REGARD TO FALLING WIRES—In the West Kentucky Telephone Company *vs.* Pharis, it was decided that it is the duty of a telephone company to use ordinary care in keeping its posts and wires in repair, and if they fall to the street to prevent them from remaining therein to the interruption of traffic. Although the plaintiff admitted in her testimony that she had previously seen the fallen wire, she testified that she had forgotten about it, and the court held that having forgotten, she was not guilty of contributory negligence.

TAXATION OF FRANCHISES—In the case of the Comptroller of the City of Buffalo *vs.* the Cross Town Street Railway Company, it was decided that the sum paid by the railroad company in return for its charter must be deducted from the city tax upon the company's special franchise. The three street railway companies of Buffalo were taxed about $50,000, according to the franchise tax law. They were already paying the city percentage taxes amounting to $51,000, and refused to pay the franchise tax, claiming that it was double taxation. According to this decision the city of Buffalo will lose nearly $400,000, which it undertook to collect in this double way.

THE POWER OF EMINENT DOMAIN IN LINE CONSTRUCTION—Under a statute organizing an electric light company, which permitted it to erect the necessary buildings and distributing apparatus, and gave it the right to enter upon any public street, lane, alley or highway to inspect, alter and repair its system of distribution, the Radnor Township Electric Light Company undertook to construct a transmission line. An abutting owner sought an injunction to prevent the continuance of the work on the plea that the eminent domain was not given in the act. The judgment was that the appellee had the power of eminent domain to the extent in which it attempted to exercise it.

THE RESPONSIBILITY OF THE COMPANY FOR INSULATION AT CROSSINGS—In Herbert *vs.* the Lake Charles Ice, Light and Waterworks Company, Limited, in Louisiana, it was decided that the obligation of an electric company whose wires are beneath those of another company, a more recent comer in the field, is not lessened by the negligence of the latter. The insulation of the defendant's wires was torn off by the new company's wires being drawn over them while the line was building. During a storm one of the upper wires broke and fell across the lower power wires, causing the death of a pedestrian. Judgment was given for $8,000, which, on appeal, was reduced to $6,000.

SUITS FOR INFRINGEMENT OF SURFACE-CONTACT SYSTEM—The Lorain Steel Company has commenced suits in the United States Circuit Court for the New Jersey district against the Wireless Electric Railway Company, of the District of Columbia, and the Central Passenger Railway Company, of New Jersey. It is alleged in the bills of complaint filed in these suits that these companies have infringed certain patents owned by the Lorain Steel Company, relating to surface-contact electric railways. It is understood that the alleged infringement complained of has occurred in the installation and operation of the surface-contact system at Atlantic City, on the road of the Central Passenger Railway Company.

INCANDESCENT LAMP INFRINGEMENT SUITS—On August 5 a suit was commenced in the United States Circuit Court for the Northern District of Illinois, Southern Division, against the Moline Incandescent Lamp Company, of Moline, Ill., by the Edison Electric Light Company, for manufacturing incandescent lamps which are alleged to infringe letters-patent No. 444,530, granted to Thomas A. Edison. This patent relates to the leading-in wires of incandescent lamps, and covers the feature of sealing into the closed portion of the glass stem leading-in wires of different metals. Suit was also commenced on July 23 in the United States Circuit Court for the Eastern District of Missouri, Eastern Division, against the E. C. Van Nort Electric Company, St. Louis, Mo., for alleged infringement of the same patent.

THE LEGAL STATUS OF TRACKLESS TROLLEY COMPANIES—Attorney-General Carson, of Pennsylvania, has advised Governor Pennypacker not to issue a charter to the Sayer Trackless Trolley Company, on the ground that such a corporation would not come under the laws governing street railways. In Mr. Carson's report he says: "All existing companies are subject to restraint; the proposed new company would be without restraint. No statute applies to it; it is not a railway, nor a railroad, nor an omnibus line. If it were attempted to subject it to restraint of existing statutes, it might be found that no statute could be judicially stretched to cover it. Hence an organic creature of the state's creation had arisen to roam at will, uncontrollable because beyond the reach of the law."

PERSONAL MENTION.

MR. GEORGE WESTINGHOUSE arrived in New York from Europe on Tuesday, August 9.

MR. JAMES B. CAHOON, the well-known consulting engineer, and late secretary of the National Electric Light Association, is making a short trip to Mexico.

HENRY DE WOLF will install the first isolated electric lighting plant ordered by the provincial board of the Philippines, at Bulacan, Province of Malolos, Philippine Islands.

MR. JAMES B. BONNAR, for three years with the Ashtabula (Ohio) Telephone Company, has accepted a position in the engineering department of the North Electric Company, Cleveland, Ohio.

MR. C. A. GILLES, assistant treasurer of the San Juan Light and Transit Company, which operates an extensive lighting and traction system in San Juan, Porto Rico, is making a visit to New York.

MR. CARL HAMBUECHEN, who has been a coworker with Professor Burgess, at the University of Wisconsin, on electro-chemical problems, is now with the Pittsburg Reduction Company at East St. Louis, Ill.

MR. NEWTON W. BOLEN, general superintendent of the Mexico City electric traction system, is visiting the United States, and is making his headquarters with the Elmer P. Morris Company, 15 Cortlandt street, New York.

MR. F. D. LAWRENCE, of the F. D. Lawrence Electric Company, Cincinnati, Ohio, with his wife and daughter, is visiting in New York. Mr. Lawrence reports quite a noticeable improvement in business throughout the South and Middle West.

MR. GEORGE C. CHADWICK has been appointed superintendent and chief engineer of the Santa Cruz Electric Railway, to succeed E. S. West, who has resigned because of ill health. Mr. Chadwick has been in the employ of the United Railways of San Francisco

for seven years. He was one of the construction engineers for the interurban electric road at San Jose. Mr. Chadwick is to have entire charge of the operating department and maintenance.

PROFESSOR CLARENCE FELTMAN, head of the department of electrical engineering at the University of Darmstadt, Germany, is in America investigating the methods for the teaching of electrical engineering.

DR. WILLIS R. WHITNEY, professor of theoretical chemistry at the Massachusetts Institute of Technology, has resigned, and will take charge of the research laboratories of the General Electric Company at Schenectady, N. Y.

MR. ELLIS BARTHOLOMEW has resigned as president of the Toledo, Columbus & Cincinnati Railway Company. Mr. E. C. Schinness has been elected to this office. Mr. Bartholomew has also resigned as a director, and the vacancy filled by Mr. A. Beesch.

MR. E. W. LAWSON has resigned his position as assistant electrical engineer of the Canton-Akron and Canton-New Philadelphia traction systems at Canton, Ohio, and accepted a position in the electrical department of the Public Service Corporation at Jersey City, N. J.

PROFESSOR A. VAN DER NAILLEN, who has conducted a school of mining engineering in San Francisco for the past thirty years, has been appointed a commissioner by the Belgium World's Fair directors to represent California at Liege, Belgium, from April to November, 1905.

PROFESSOR EDGAR F. SMITH, University of Pennsylvania, has been awarded the degree of LL. D. by the University of Wisconsin. Professor Smith has done some excellent work on the electrolytic separation of metals as well as researches upon the compounds of tungsten, molybdenum and uranium.

MR. A. B. CRAWFORD, manager of the Home Telephone Company, Hamilton, Ohio, has resigned, and, it is understood, will leave Hamilton to undertake other work. Mr. W. B. Thompson, of Lebanon, Ohio, has been appointed manager to succeed Mr. Crawford, whose resignation takes effect on September 1.

MR. E. L. NASH has been appointed district manager of the General Incandescent Arc Light Company, New York city. Mr. Nash's headquarters will be at 1208-1209 North American Building, Philadelphia, Pa. Mr. Nash has been connected with the Jandus Electric Company in the capacity of eastern sales manager for the last nine years.

MR. ROSCOE CORNELL has been appointed manager of the branch office which the Allis-Chalmers Company has opened in El Paso, Tex. Mr. Cornell is a graduate of the Michigan College of Mines, and is well known as a mining and mechanical engineer. He joins the staff of the Allis-Chalmers Company from the Mine and Smelters' Supply Company, of Denver, Col. He has held a number of prominent positions as a mining engineer and as a smelter and mine superintendent. His extensive acquaintance and experience with engineering undertakings thoroughly qualifies him to fill the important position to which he has been appointed.

ELECTRICAL SECURITIES.

From an analysis of reports from different sections of the country regarding the industrial situation at large, it is evident that there is being manifested a steady increase in confidence. While railroad earnings have shown decreases in gross, conservative economies have made for large net profits, and therefore satisfactory returns. The latest government reports on the cereal situation do not bear out the announcements of extensive damage, and it is probable that whatever loss there may be in this season's crop will be confined to a certain limited area. The latest reports from foreign centres of distribution show that the shortage there will be even greater than was at first predicted, and this will bring about a large foreign demand, with consequent good prices.

Except in the anthracite regions, there was little change in the labor situation during the week. In Chicago and Fall River the situation remained about the same, while in the anthracite dispute the mine workers' representatives on the conciliation board have agreed to accept an umpire to settle the differences in question.

Metropolitan Street Railway and Metropolitan Securities attracted a great deal of attention early in the week, and, following a rumor that large interests were to be disclosed, there was considerable buying, with a rise between three and four points. As each day passed without any verification of this announcement, the stock fell off, but has retained considerable of the advantage of the early week manipulation.

ELECTRICAL SECURITIES FOR THE WEEK ENDING AUGUST 13.

New York:	*Closing.*
Brooklyn Rapid Transit	54¼
Consolidated Gas	195¾
General Electric	163
Kings County Electric	210
Manhattan Elevated	150¾
Metropolitan Street Railway	123
New York & New Jersey Telephone	152
Westinghouse Manufacturing Company	165

The receipts of the Interborough Rapid Transit Company from the excess earnings of the Manhattan Railway Company above the 7 per cent guarantee and from advertising privileges already contracted for, will, it is estimated by Interborough interests, pay all fixed charges (3½ per cent interest on the $35,000,000 of New York city bonds which were issued to build the underground road), leaving the entire earnings of the underground system to go to the stockholders. The engineers of the Interborough company are of the opinion that the company will earn 8 per cent upon its $35,000,000 of stock from the start.

The company's statement for the quarter and twelve months ended June 30, 1904, compares as follows: three months' gross, $3,746,101; expenses, $1,532,213; three months' net, $2,213,888; other income, $81,768, a total of $2,295,656; charges, $1,537,222, leaving a surplus of $758,434, as compared with $547,322 for the corresponding period of 1903. Twelve months' gross, $14,187,684; expenses, $5,846,052; twelve months' net, $8,341,632; other income, $341,504, making a total of $8,683,136; charges, $6,757,412; surplus, $1,925,724, as against $4,273,543 for preceding year. The company's general balance sheet as of June 30, 1904, shows total assets of $40,393,852, and liabilities of $38,620,804, leaving a surplus of $1,773,048. The Manhattan Railway Company's balance sheet compares as follows: assets, $104,485,850; liabilities, $97,378,150; surplus, $7,107,700.

Directors of the Kings County Electric Light and Power Company have declared the regular quarterly dividend of 2 per cent on the capital, payable September 1. Books will remain closed from August 19 to September 1.

Boston:	*Closing.*
American Telephone and Telegraph	138
Edison Electric Illuminating	263
Massachusetts Electric	69
New England Telephone	123
Western Telephone and Telegraph preferred	91

Philadelphia:	*Closing.*
Electric Company of America	9¼
Electric Storage Battery common	59
Electric Storage Battery preferred	59
Philadelphia Electric	6¼
Union Traction	53⅞
United Gas Improvement	87½

Chicago:	*Closing.*
Chicago Telephone	120
Chicago Edison Light	143
Metropolitan Elevated preferred	52½
National Carbon common	34
National Carbon preferred	105½
Union Traction common	4
Union Traction preferred	26

The directors of the Metropolitan West Side Elevated, at their meeting, took no action on the preferred stock dividend.

Stockholders of South Side Elevated have authorized an issue of $8,000,000 4½ per cent bonds to build the Englewood extension. Of this amount $3,000,000 will be issued at once and offered to stockholders at par. The vote was 78,700 shares in favor, and 2,900 shares against.

ELECTRIC RAILWAYS.

BUFFALO, N. Y.—The new power plant of the Buffalo, Gardenville & Ebenezer Electric Railway has been placed in operation.

PORTLAND, ME.—It is stated that the proposal to build an electric road through some of the northern towns of Aroostook County is again being revived.

WEST CHESTER, PA.—Plans for six miles of trolley road, to provide the Schuylkill Valley Traction Company with a line from Norristown to Pottstown, have been recorded.

PAPILLION, NEB.—Preliminary work has started on the Omaha & Southwestern Electric Railway. Graders are on the ground, and it is promised the work will be pushed to completion.

BLACKFOOT, IDA.—A project is on foot to build an electric railway line from Nampa to Star and the Givens hot springs, near the Snake river, about fifteen miles from Nampa.

SALEM, ORE.—The Citizens' Light and Traction Company has under way and in contemplation very extensive improvements and changes to its system of lighting and transportation.

ALLIANCE, OHIO—Grading for the new roadbed for the Stark electric line, which will connect this city with Salem, Ohio, has been completed. Cars will be running by September 1.

HULL, MASS.—The Hull board of selectmen has decided to grant a franchise to petitioners for the introduction of a system of trackless trolley cars between the state reservation at Nantasket and Nantasket Point, a distance of two miles.

BUFFALO, N. Y.—Plans to extend the Buffalo, Gardenville & Ebenezer Railway have been prepared and the work has already been started. Pennsylvania capital has gained control of the road and it will be materially extended and improved.

HARTFORD, CT.—Progress is being made on the scheme of the East Lyme Street Railway Company to build a trolley line from New London through Waterford to Niantic, in the town of East Lyme. The surveys have been completed and the plans for building have been matured.

GENEVA, N. Y.—Negotiations are said to be pending for the sale of the Geneva, Waterloo, Seneca Falls & Cayuga Lake Trolley Company to a Philadelphia syndicate. The plan is to build the line through to Auburn, there to connect with the Syracuse & Auburn trolley road, now in operation.

MUSKOGEE, I. T.—The Muskogee Electric Company has filed articles of incorporation and begun work on its line. The company is capitalized at $100,000, and the officers are: Ira L. Reeves, president; J. A. Connolly, of Titusville, Pa., vice-president; A. C. Trumbo, secretary; N. A. Gibson, treasurer.

HAMMONTON, N. J.—The construction of a trolley road between this city and Vineland, a distance of eighteen miles, is being agitated by the board of trade. Thomas C. Elvins, Albert L. Jackson and Benjamin W. Richards have been appointed a special committee to investigate the feasibility of the plan.

DU BOIS, PA.—The promoters of the Elk County trolley line are planning to connect Ridgway and St. Marys, possibly taking in Centerville and Earlyville, extending the road later to Johnsonburg. It is stated that the line will be ready for operation between St. Marys and Ridgway by the first of next year.

ST. JOSEPH, MO.—Surveys have been commenced for the proposed St. Joseph, Albany & Des Moines electric line. The line as at present planned will touch at Clair, Clarksdale, Oaks, Woods, Fairport, Berlin, Gentryville, Devona, Albany, and thence will proceed in a generally northerly course to Des Moines.

COLUMBUS, IND.—Charles N. Wilson says that final arrangements for the construction of the Columbus, Greensburg & Richmond Traction Company were made by himself and Harris F. Holland, president of the proposed road, on a recent visit to New York city, and offers the assurance that it will soon be a reality.

GALESBURG, ILL.—The following have been elected directors of the Galesburg Motor and Power Company: W. B. McKinley, Champaign; H. E. Chubbuck, Ottawa; Edward Woodman, George F. Duncan, George Lunt and George Burnham, Portland, Me., and F. C. Duncan, R. A. McLaughlin and Walter Achalpole, of Galesburg. The company will practically rebuild its Main street line, and make other needed improvements.

MEMPHIS, TENN.—The movement which was inaugurated some time ago, looking toward the construction of an electric car line in Columbus, Miss., has taken definite shape. A company, to be composed of local and other capitalists, has asked for a franchise for ninety-nine years, agreeing to have the power-house built and one mile of the line completed and in operation within one year from date of granting the franchise.

ROCHESTER, N. Y.—The John R. Lee Electrical Construction Company has been incorporated with a capital of $300,000. The following are the directors: John R. Lee, Paterson, N. J.; James D. Lazell, of New York city, and E. S. McNaul, of Philadelphia. The company will build an electric trolley line from this city to Lockport and Niagara Falls, connecting at Lockport with the electric lines to Buffalo and Tonawanda.

ELMIRA, N. Y.—The Elmira & Corning Short Line Railroad Company has made a change in the plans for the construction of the proposed road between this city and Corning. Instead of the third-rail system an overhead trolley will be substituted. The state railroad commissioner objected to the third-rail system. Plans and specifications are now being made, and as soon as a favorable decision is given by the commission upon the application to build the work will be begun.

SPRINGFIELD, ILL.—At a meeting of those interested in the new interurban proposition between Springfield, Bloomington and Peoria, reports were made which showed that the line between Springfield and Lincoln had been completely surveyed, and that the work of securing the right of way and the necessary franchises was progressing rapidly. The first portion of the line will be built from Springfield to Lincoln, and that between Bloomington and Lincoln as soon as the other has been completed.

KANSAS CITY, MO.—An application has been filed by the Kansas City & Topeka Railway Company for a franchise to operate an electric road in Wyandotte County, Kan. This company is the assignee of the Kansas City & Olathe Electric Company. The county commissioners appointed B. L. Stine, of Rosedale, to look after the claims against the old company, and no franchise will be granted to the new company until all the old claims have been settled in full. The new company, through its attorney, says that these claims will all be paid at once and that no time will be lost in beginning work on the new road.

LANCASTER, PA.—At the annual meeting of the Lancaster County Railway and Light Company it was reported that the total income from the trolley lines owned and leased and from the lighting plants owned by the company, was $148,241.97, and the total expenses $66,983.29, leaving net earnings of $81,258.68. New lines are contemplated to Mount Joy, Quarrysville and several other points, and a short line is to be built between Adamstown and Mohnsville, which will connect the trolley systems of Lancaster and Berks counties. A new line has just been opened between New Holland and Blue Ball.

PUTNAM, CT.—The project for the construction of a street railway from Webster, Mass., to Providence, R. I., is now under consideration. Representatives of the New York and Philadelphia interests that are considering the enterprise have recently gone over the route and have studied the possibilities of the line. If the road is built the route will run through Pascoag, R. I. Other Rhode Island towns which will be touched are Harrisville and Oakham. The undertaking is to be entirely independent of the Consolidated Railway Company, which controls and operates a large trolley mileage in eastern Connecticut and southern Massachusetts.

PHILADELPHIA, PA.—The United Railways and Electric Company, of Baltimore, has decided to issue car trust certificates to purchase new electric cars. The company has ordered 150 cars for winter service, to be delivered in the fall, at a cost of $400,000, and the car trust notes to be issued in payment have already been purchased by a Baltimore banking firm. The company, it is said, has treasury assets more than enough to pay for the cars, but rather than dispose of them at this time it has determined upon the new plan of payment. The certificates will bear interest at five per cent and run for ten years, ten per cent of the total issue to be retired each year.

ELECTRIC LIGHTING.

WILMOT, S. D.—The question of installing an electric light plant is receiving consideration.

CALUMET, MICH.—The Houghton County Electric Light Company has begun extending its electric lines from Atlantic to South Range.

SYRACUSE, N. Y.—The board of supervisors has awarded the contract for building the court-house power plant to Henry Ryan, for $90,800.

LORAIN, OHIO—The new power-house of the Citizens' Gas and Electrical Company has been placed in operation, and is now lighting the entire city.

PITTSBURG, PA.—A resolution has been passed authorizing the preparation of plans and specifications for the repair and remodeling of the electric light plant.

TUSCUMBIA, ALA.—The Sheffield Company expects to be able to light Tuscumbia and Sheffield within the next thirty days. The entire plant, including its street car line, will then be completed.

WAUSAU, WIS.—The city council has voted to build a municipal lighting system and buy the current from the Wausau Electric Company at the rate of 2.3 cents per kilowatt-hour, or $44.84 per street lamp per year.

ELKTON, MD.—The commissioners of the town of Aberdeen have purchased of W. W. Reynolds the electric light plant in that town. The plant will hereafter be operated by the municipality.

KALAMAZOO, MICH.—Plainwell is to have a new power and light plant. It is under the management of John F. Eesley, and will be known as the Eesley Light and Power Company, capitalized at $30,000.

ABERDEEN, MD.—The town commissioners have purchased a piece of ground on which to erect a power-house for the electric light plant. The building will be thirty-two by sixteen feet and one story high.

MONTICELLO, N. Y.—The Monticello Electric Light and Power Company will erect a new power-house near the station now in operation. The old plant will be retained, giving the company two plants in case of emergency.

WEST CHESTER, PA.—John M. Entriken has been awarded the contract for the erection of the new electric light plant. The managers held a meeting recently, when the preliminary arrangements were made. They expect to be able to furnish light by September 1.

DENVER, COL.—Jacob E. Himes and several Kansas City associates are considering the establishment of a power plant near Curtis, in Summit County. Water will be piped from Ten Mile Canon, from a point named Wheeler, and in going this distance a fall of some 500 feet will be obtained, which it is expected will generate fully 40,000 horse-power.

BATESBURG, N. C.—The electric lights and waterworks commission has contracted with Frederick Minshall, of Abbeville, for the construction of water and light plants for the town of Batesburg, for an amount not exceeding $18,500. Six months is the time required for completion of contract. A suitable location has been secured on Hartley hill, considerably elevated above the town.

MONTGOMERY, ALA.—The Tallageda Electric Company has filed articles of incorporation. The company proposes to construct and operate traction lines and mills, and to furnish electric power for other enterprises. It has a capital stock of $50,000. The incorporators are George W. Chambers, J. S. Chambers and George O. Chambers.

DENTON, TEX.—The city of Denton has filed suit against the Denton Water, Light and Power Company for damages in the sum of $45,000, alleged to have been caused by violations of the terms of contract made several years ago between the plaintiff and defendant, and also for the setting aside by the court of the franchise granted by the city.

SUMPTER, ORE.—An electric power company, composed largely of stockholders in the Dixie Meadows mine, has been organized for the purpose of developing power from the middle fork of the John Day river. The name of the company is the Middle Fork Electric Power Company, and R. C. Reese is president. It is estimated that 700 horse-power can be developed.

HOLYOKE, MASS.—The report of the operation of the municipal lighting plant shows that the total receipts for the six months ending May 31 were $110,531.96; total expenses, $99,662.84; excess of receipts over expenses for that period, $10,869.12, to which is added $14,541.63, balance on hand at the beginning of the fiscal year, making the balance on hand May 31, $25,410.75.

COLORADO SPRINGS, COL.—The property of the Colorado Electric Power Company, of this city, has been sold at auction to the Union Trust Company, of Pittsburg, Pa., for $215,871.10. The purchasing company held a mortgage of $219,000, of which $14,000 had been paid. To the balance of $205,000 was added the sum of $10,871.10 for the services of the trust company, making the total the purchase price.

TURNER, MASS.—The Franklin Electric Light Company elected these officers at its annual meeting: president, J. F. Bartlett; clerk, E. I. Cassidy; treasurer, W. C. D. Thomas; directors, Porter Farwell, C. W. Hazelton, H. D. Bardwell, W. D. Russell. Within a year the company will be able to obtain power from the Turners Falls company, and will then be in a position to greatly extend its system in the village.

REDDING, CAL.—J. E. Frick, of Berkeley, has appropriated 40,000 inches of water, to be taken from Rising river and Crystal lake, both tributaries of Hat creek, at a point six miles east of Redding, for power purposes. Mr. Frick says that San Francisco people are interested with him, and that they will form a company, install a plant, and run a line down the Sacramento valley to furnish light and power to many cities and towns.

HERKIMER, N. Y.—The certificate of incorporation of the Middleville Electric Light Company has been filed at the county clerk's office. The object of the corporation is to light the village of Middleville and the towns of Fairfield and Herkimer. The company has a capital stock of $4,000. The directors for the first year are as follows: Lewis E. Goodman, David E. Ford and Anna M. Goodman. The principal office of the company is to be in Middleville.

NASHVILLE, TENN.—Information has been received here that the New York syndicate which is being formed for the purpose of building an electric power plant at Caney Fork falls, has now secured subscriptions for all of the $100,000 of capital stock it proposes to issue. Meikleham & Dunsmore, of New York, and C. H. Ackerman, of Binghamton, N. Y., are promoters of the syndicate, which purposes to take over the franchise and property of the present Great Falls Power Company, composed of Nashville and Detroit men, and of which A. J. Dyer is president.

ALTOONA, PA.—The purchase of the holdings of J. Edward Horn, E. H. Ellsworth and W. S. Montgomery in the Phillipsburg Electric Light Company by J. G. Platt, C. H. Rowland, J. Swires, O. L. Schoonover, G. W. Haworth, J. H. Turnbach, James Passmore and H. M. Hughes has been consummated and the new owners are now in charge. The purchasers, who are also owners of the electric railroad, propose to enlarge the capital stock, issue bonds and greatly increase the facilities of the plant, giving day as well as night services, and furnishing light to the people of adjacent communities. The Moshannon Light and Power Company, constituted virtually of the same parties, and chartered some time ago, to furnish light to the people along the line of the trolley, will be merged with the old company.

BAKER CITY, ORE.—The new power plant of the Baker City Gas and Electric Light Company, on Rock creek, about twenty miles southwest of this city, is now complete and in commission. This is the first power plant in this part of the state to make use of the water power in the mountains on a large scale to generate electric power for commercial purposes. The water is brought down to the power-house, which is located about a mile up the canyon from the village of Rock Creek, under a head of 940 feet. At present there are two 500-horse-power dynamos, each driven by a 500-horse-power Pelton water-wheel. The water flows onto the wheel through a 2.65-inch nozzle. Each dynamo generates a current of 2,300 volts, which is increased to 23,000 for transmission over the wires to this city, where it is again reduced to 2,300 volts.

INDUSTRIAL ITEMS.

THE HOLLAND-ROSS MACHINE COMPANY, Madisonville, Ky., manufacturer of coal-handling machinery, announces that it is in the market for ten and twelve-horse-power, 250-volt electric motors.

GOUDEY-McLEAN COMPANY, 120 Liberty street, New York, has been appointed sales agent for Greater New York for the Germania Electric Lamp Company, of Harrison, N. J., manufacturer of incandescent lamps.

THE CUTLER-HAMMER MANUFACTURING COMPANY, Milwaukee, has issued leaves of its perpetual catalogue covering controllers, dimmers, resistance units and self-starters, with accompanying connection diagrams and tables.

THE GENERAL INCANDESCENT ARC LIGHT COMPANY, 529 West Thirty-fourth street, New York city, has been awarded the contract for a large number of "G. I." arc lamps (110 volts, direct-current) for John Wanamaker's new New York store.

H. M. BYLLESBY & COMPANY, Chicago, Ill., have been appointed engineers for the Fort Smith Light and Traction Company, of Fort Smith, Ark. Extensive improvements and additions to the electric light, gas and street railway systems will shortly be undertaken.

THE BULLOCK ELECTRIC MFG. COMPANY, Cincinnati, has mailed bulletins Nos. 1002A, descriptive of the type "N" motors; 1026, multipolar motors and generators; 1028, Bullock system of control for variable speed electric motors, and 1029, engine-type generators.

THE ELECTRIC APPLIANCE COMPANY, Chicago and San Francisco, has issued catalogues Nos. 22 and 23, the former of overhead railway and insulating material; the latter of electric supplies for gas, gasoline engines and automobiles. These catalogues are very neatly printed and cover their respective fields very thoroughly.

THE EDISON ELECTRIC ILLUMINATING COMPANY OF BROOKLYN, 360 Pearl street, Brooklyn, N. Y., has published in the "Brooklyn Edison" for August an elaborate summary of the spectacular illumination of Coney Island during the present season. A fine series of night views is shown, and this is supplemented by a careful description of the respective installations.

THE AMERICAN ELECTRIC FUSE COMPANY, Chicago, Ill., is calling attention to its No. 402 protector. This protector is made to be used outside, and the dome and bracket are galvanized and will not rust. The base is of porcelain. The wires enter from the bottom through binding-posts. The protector is easy to install and may be placed on the pole or on the side of the house.

THE A. STORRS & BEMENT COMPANY, 138-140 Federal street, Boston, Mass., extended a general invitation to the electrical fraternity and its friends to make use of its offices during the encampment week of the G. A. R., August 15 to 20, or at any other time that they might be in Boston. Facilities are at hand for the reception of mail, the writing of letters, or the meeting of acquaintances.

THE ENGINEERING COMPANY OF AMERICA, 74 Broadway, New York city, has published an interesting and instructive pamphlet on concrete construction. This pamphlet takes up briefly the history of concrete construction and the adaptability of reenforced concrete for modern structural work. The pamphlet is published by Bruce & Johnston, 42 Broadway, New York city, and the typography and illustrations show careful preparation and high-class execution.

THE D. & W. FUSE COMPANY, Providence, R. I., announces that it has secured the contract for furnishing the entire fuse equipment for the Rapid Transit Subway Construction Company, constructing the Interborough Rapid Transit Company's system. This order was secured after tests had been made on large-capacity fuses which the company submitted. These fuses were for 800 amperes, to be tested on a dead short-circuit. The company recently secured the fuse equipment contract of the Manhattan Elevated Railway.

THE SPRAGUE ELECTRIC COMPANY, 527 West Thirty-fourth street, New York city, has issued a handsome catalogue in two colors descriptive and illustrative of industrial applications of Sprague motors for direct current. This is designated as bulletin No. 218. The various applications of the Sprague electric motors are shown very completely, and indicate the unlimited uses to which these motors may be applied. Their adaptability is practically universal where direct current is used. The many years that they have been in successful service demonstrate the reliability of their design and construction.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., announces that it is prepared to quote prices on repairing burned-out transformers of the core type of any make. It wishes to assure its customers that any orders secured will receive prompt and careful attention. As sales agent for Pittsburgh transformers the company states that it has experienced gratifying business so far this year, with prospects of good orders to come. The company is prepared to furnish boosters manufactured by the Pittsburgh Transformer Company. The demand for these is continually growing, and the company anticipates a good business during the coming season.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has issued lists No. 2127, concerning wrought copper cable terminals; No. 2135, combined socket and shade holder; No. 2136, descriptive of the parallel rod, edgewise wound, direct-current, multiple 110-125-volt enclosed arc lamps; No. 2137, ceiling rosettes with enclosed flues; No. 4376, street lighting by series, direct-current, enclosed arc system; No. 4380, type T. D., voltage for direct-current generators; No. 7585, repair parts of G. E. 73-C and E railway motors, and No. 7586, repair parts of CB-15-G railway motors and also an index of bulletins. This literature will be mailed upon request.

THE LOCKE INSULATOR MANUFACTURING COMPANY, Victor, N. Y., manufacturer of the Locke patent high-potential insulators, has carried forward to a remarkable degree the manufacture of insulators for high potentials. The progress in high-tension transmission of power has been accompanied by a steady increase in test voltages to which insulators are subjected. With an eye to a still further increase, and also to enable systematic study of insulating problems, the company has recently installed a 200,000-volt transformer of 200 kilowatts capacity. The primary will be supplied with current from a 200-kilowatt motor-generator set, connected with a neighboring transmission line.

THE STURGESS GOVERNOR ENGINEERING COMPANY, Watervliet, N. Y., in bulletin No. 5 describes the Sturgess self-contained water-wheel governors. This apparatus has the governor and pump both mounted upon the same base. The base is a hollow cylinder containing the oil under pressure which operates the governor. The machine is extremely compact, and has all parts readily accessible. These governors are intended primarily for small wheels and where it is desired to have a governor which can be installed with a minimum of skill and expense. The governor is shipped all ready to start up after it is connected to the gates. The company, of course, manufactures the standard governors in which the governor, pump and tanks are separated for large units.

THE NATIONAL BATTERY COMPANY, Buffalo, N. Y., is making ready for considerable enlargements in its equipment for the manufacture of storage batteries. The history of this factory is rather interesting. It was put into the corporation known as the American Bicycle Company, which later became the Pope Manufacturing Company. From this company the entire capital stock has been purchased by individuals, who at the present time are extending the large factory buildings and improving the interior arrangements so that all manufacturing methods and systems will be thoroughly up to date. The chemical and electrical laboratories have been greatly increased in size, and are being equipped with the latest types of every variety of instrument required for experimental work. The largest product of the factories is batteries for power plants and various kinds of stationary work. After these the railroad and telephone batteries are the next important. For the manufacture of automobile storage batteries separate departments have been made, and as the demand for this material rises and falls, according to the season of the year, the factory output will be well able to take care of the demand and, at the same time, not interfere with the more continuous and larger volume of business in stationary power batteries. New space is to be occupied on Massachusetts avenue, at Buffalo, adjoining the present factory. This structure will be 111 by 500 feet. The present forming rooms will be enlarged by the addition of a two-story wing 52 by 144 feet. The organization includes the president, whose offices are at 253 Broadway, New York city; the vice-president, who is general manager, and his assistant; the treasurer, the chief engineer and the chief chemist, with a corps of assistants.